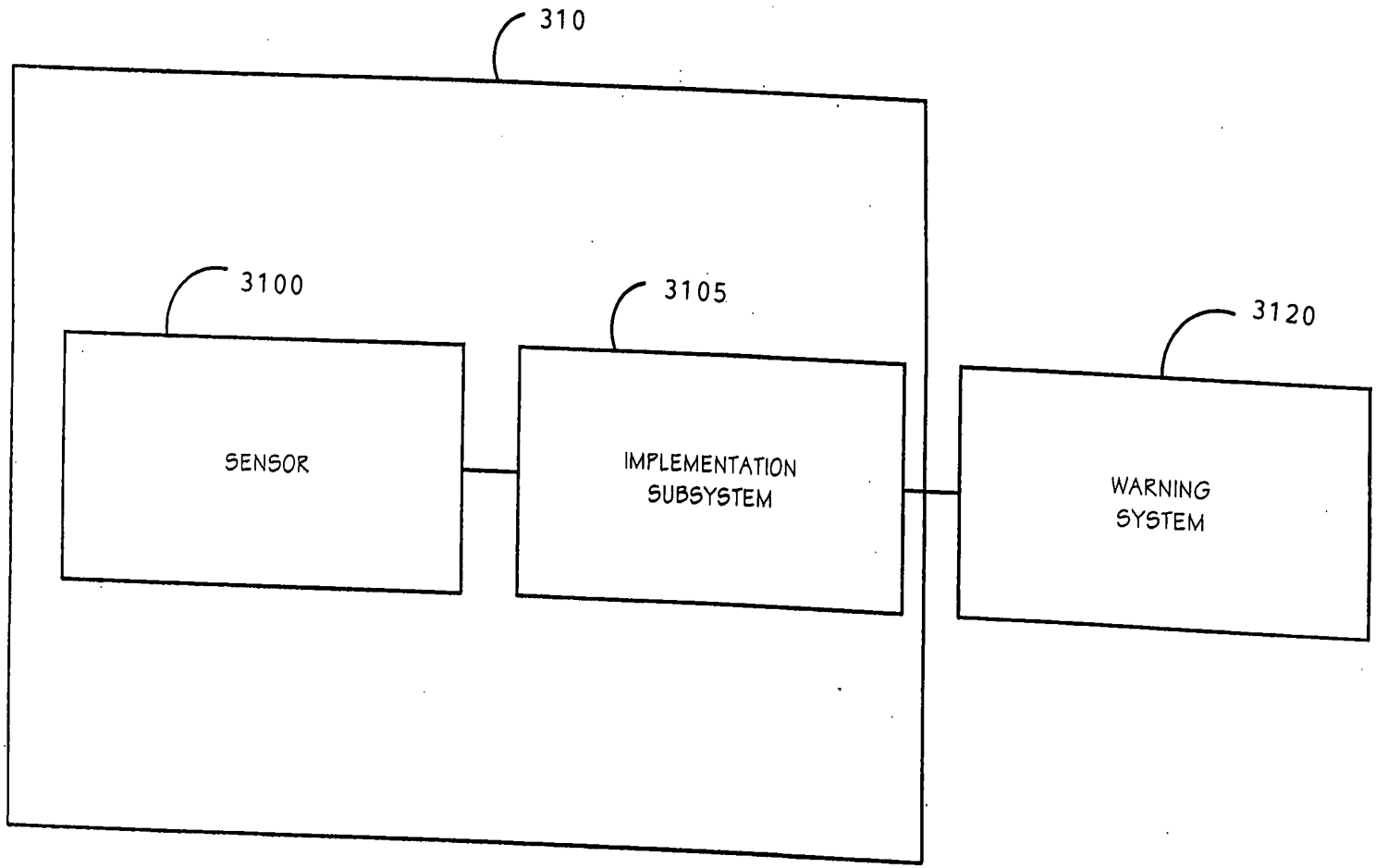
310
3100
SENSOR
3105
IMPLEMENTATION SUBSYSTEM
3120
WARNING SYSTEM

FIG. 1

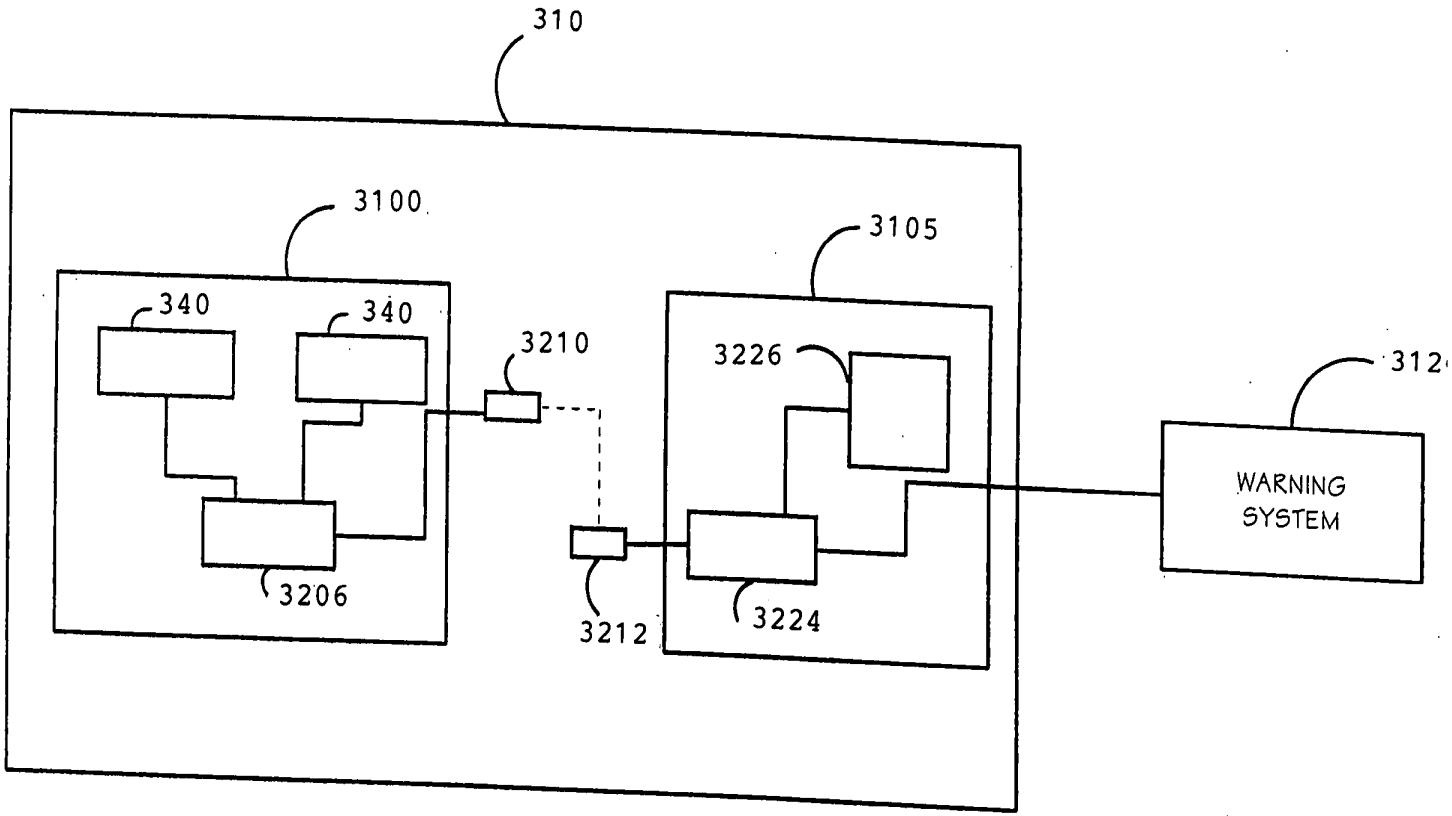
310
3100
3105
340
340
3210
3226
312
WARNING
SYSTEM
3206
3212
3224

FIG. 2

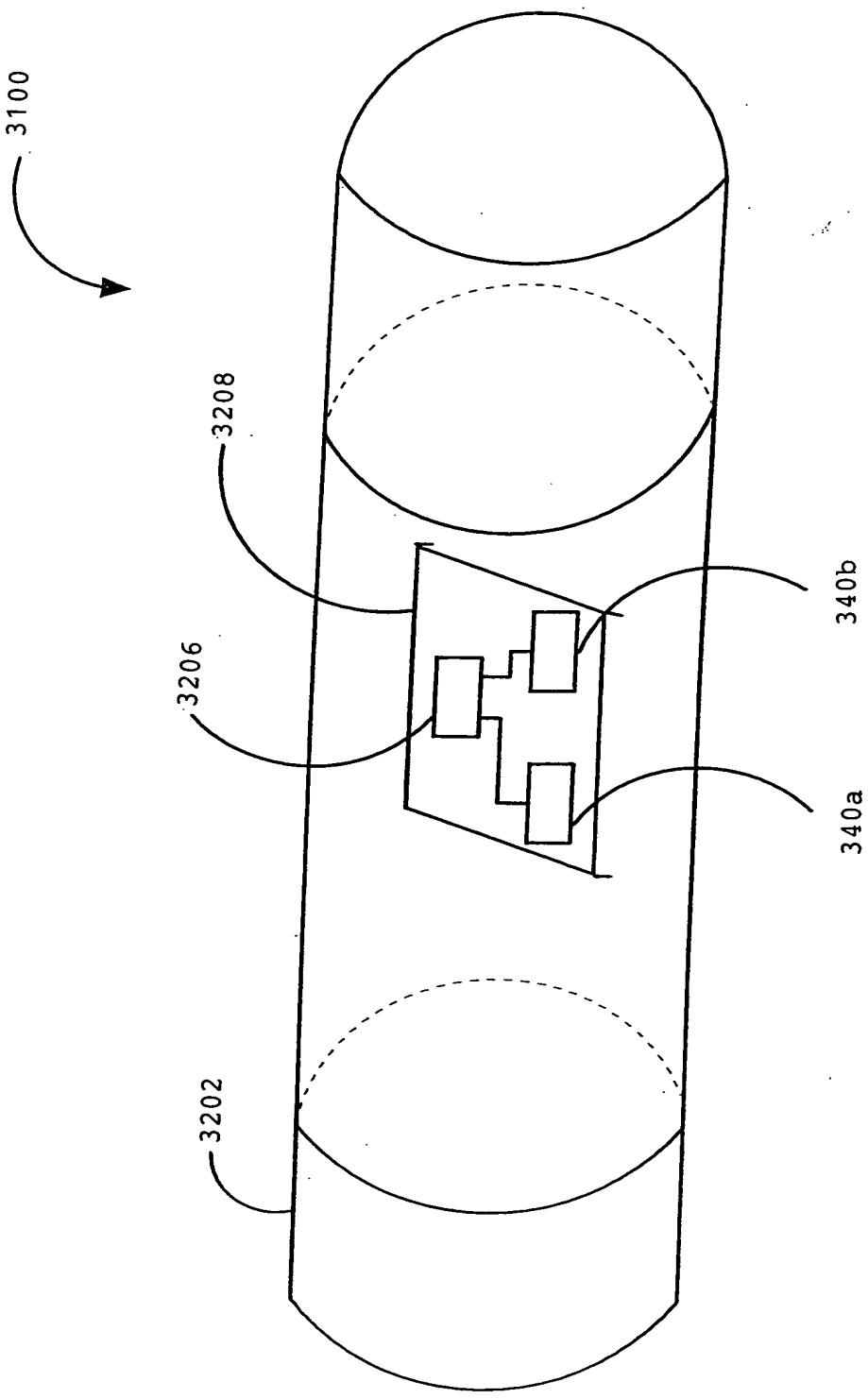

FIG. 3

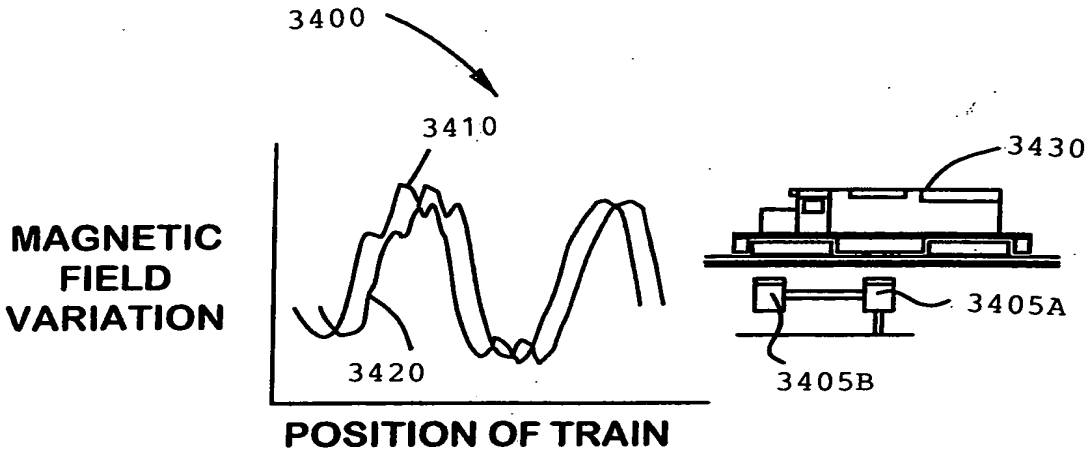
3400
3410
3430
MAGNETIC FIELD VARIATION
3405A
3420
3405B
POSITION OF TRAIN

FIG. 4A

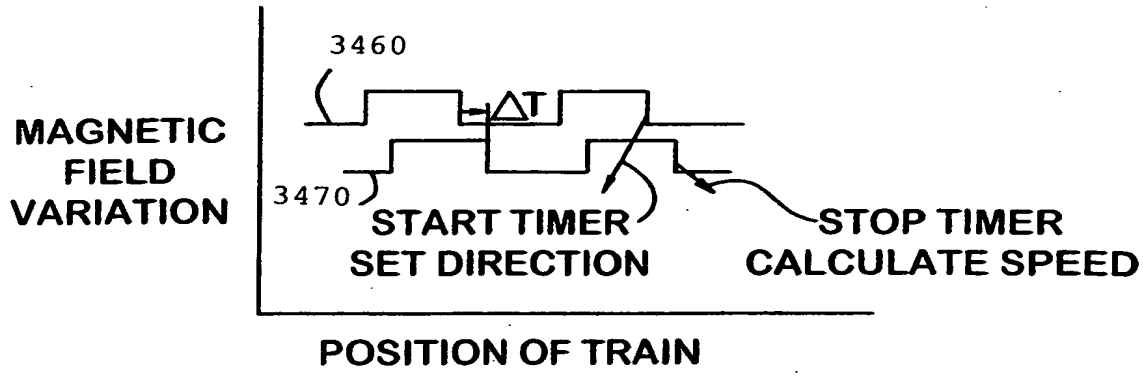
3460
ΔT
MAGNETIC FIELD VARIATION
3470
START TIMER SET DIRECTION
STOP TIMER CALCULATE SPEED
POSITION OF TRAIN

FIG. 4B

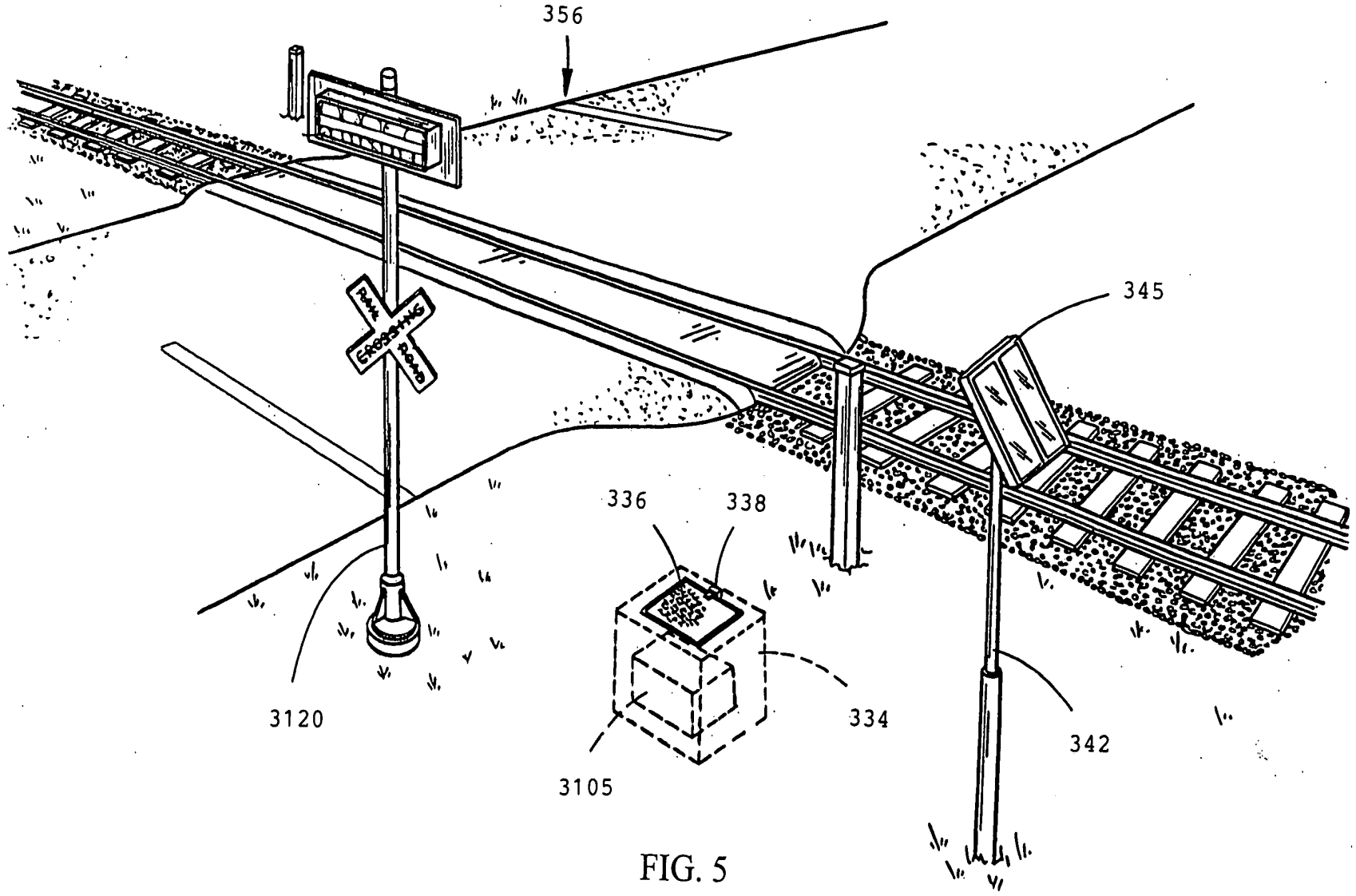

FIG. 5

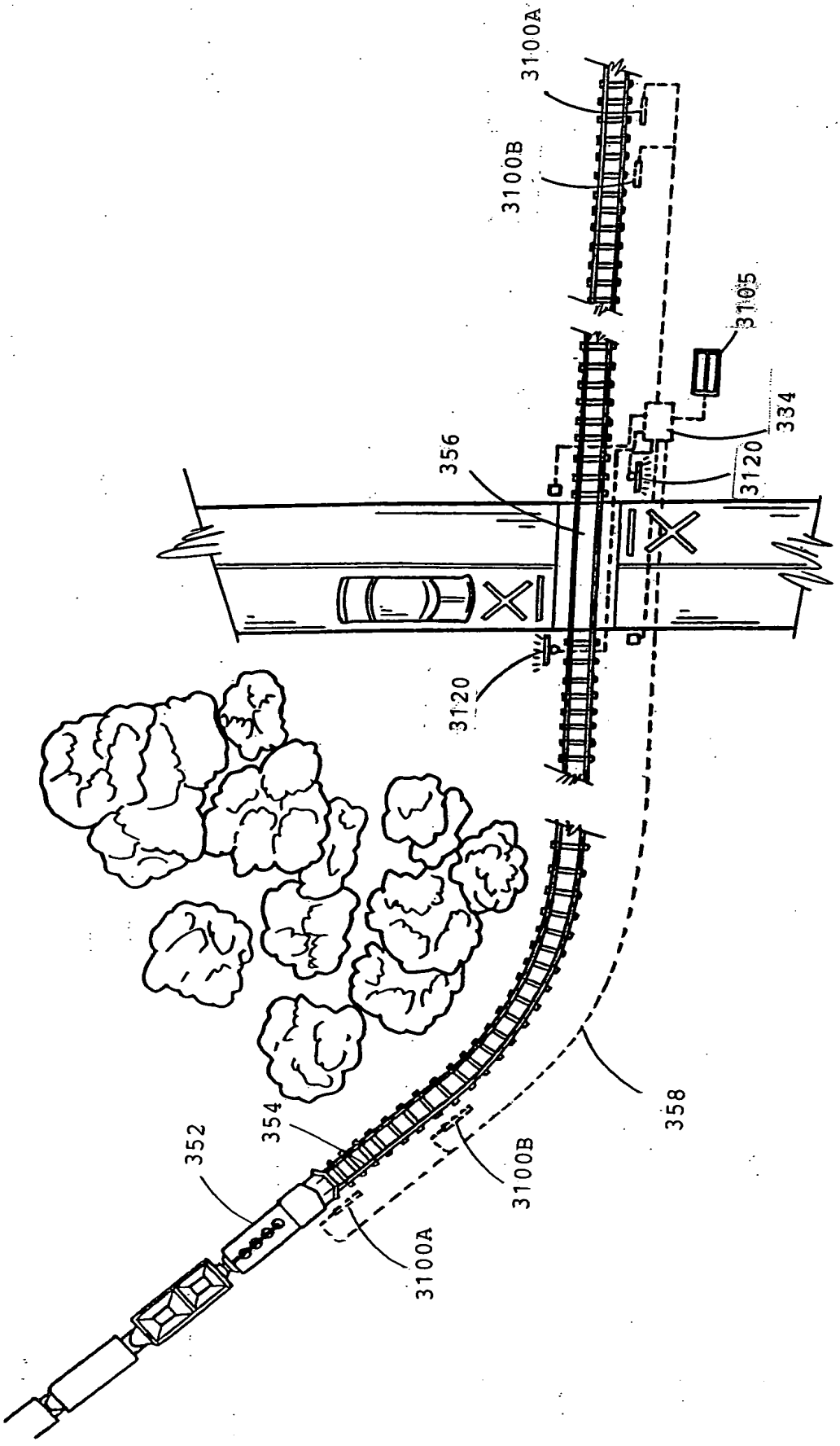

FIG. 6

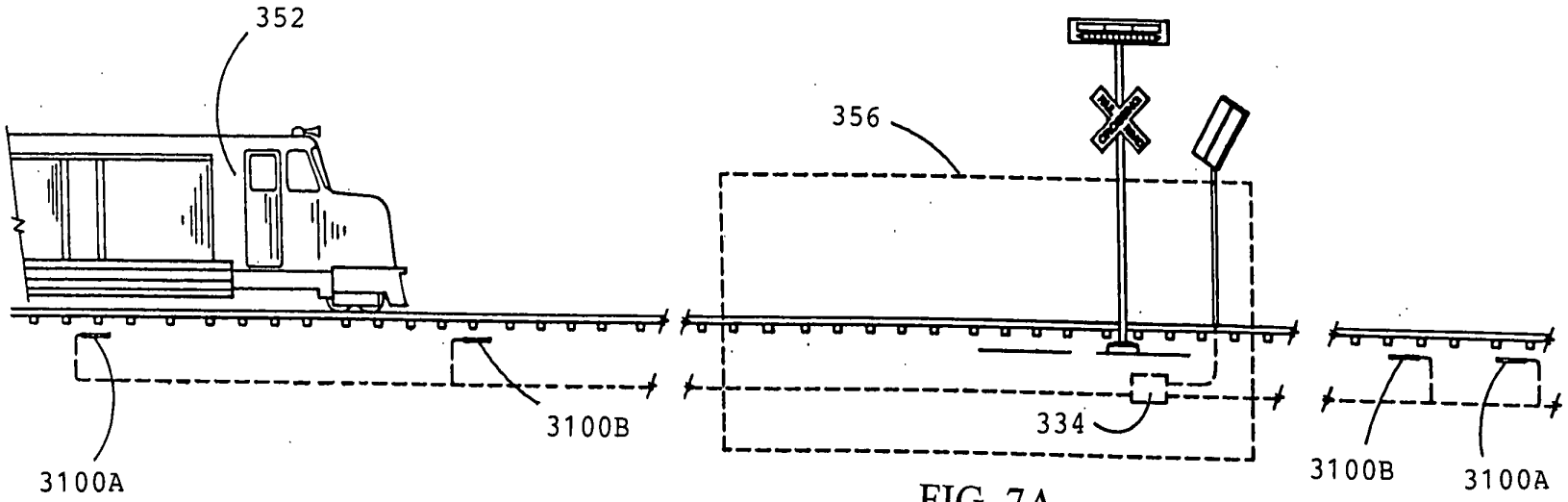

FIG. 7A

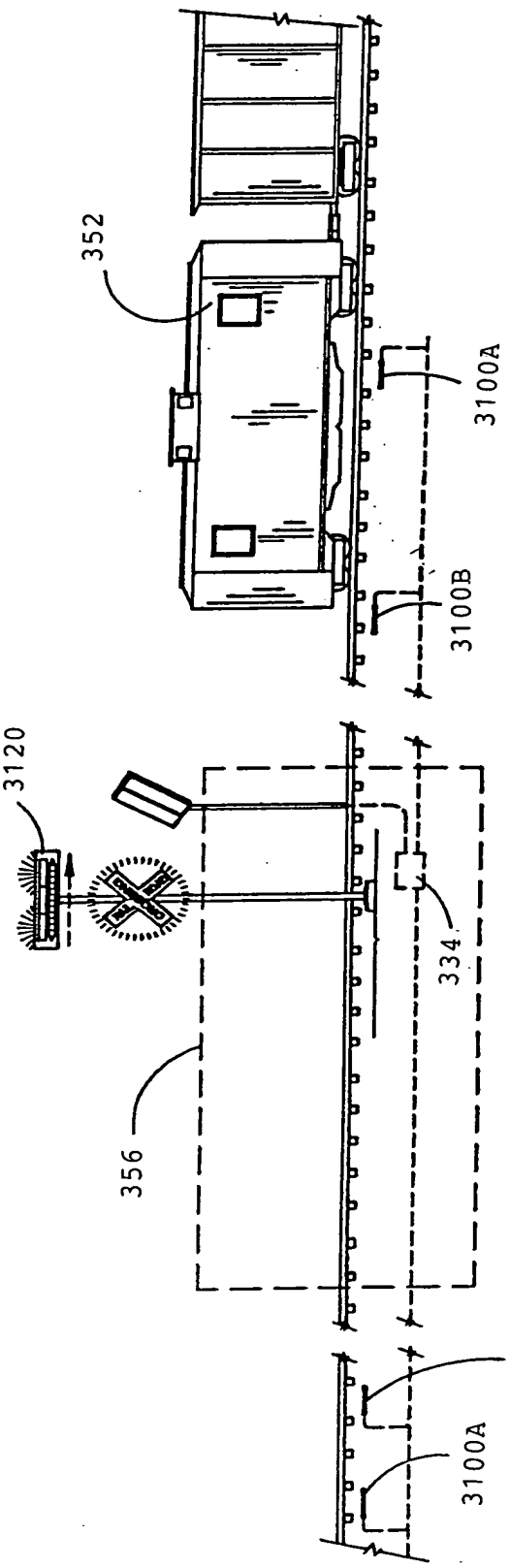

FIG. 7B

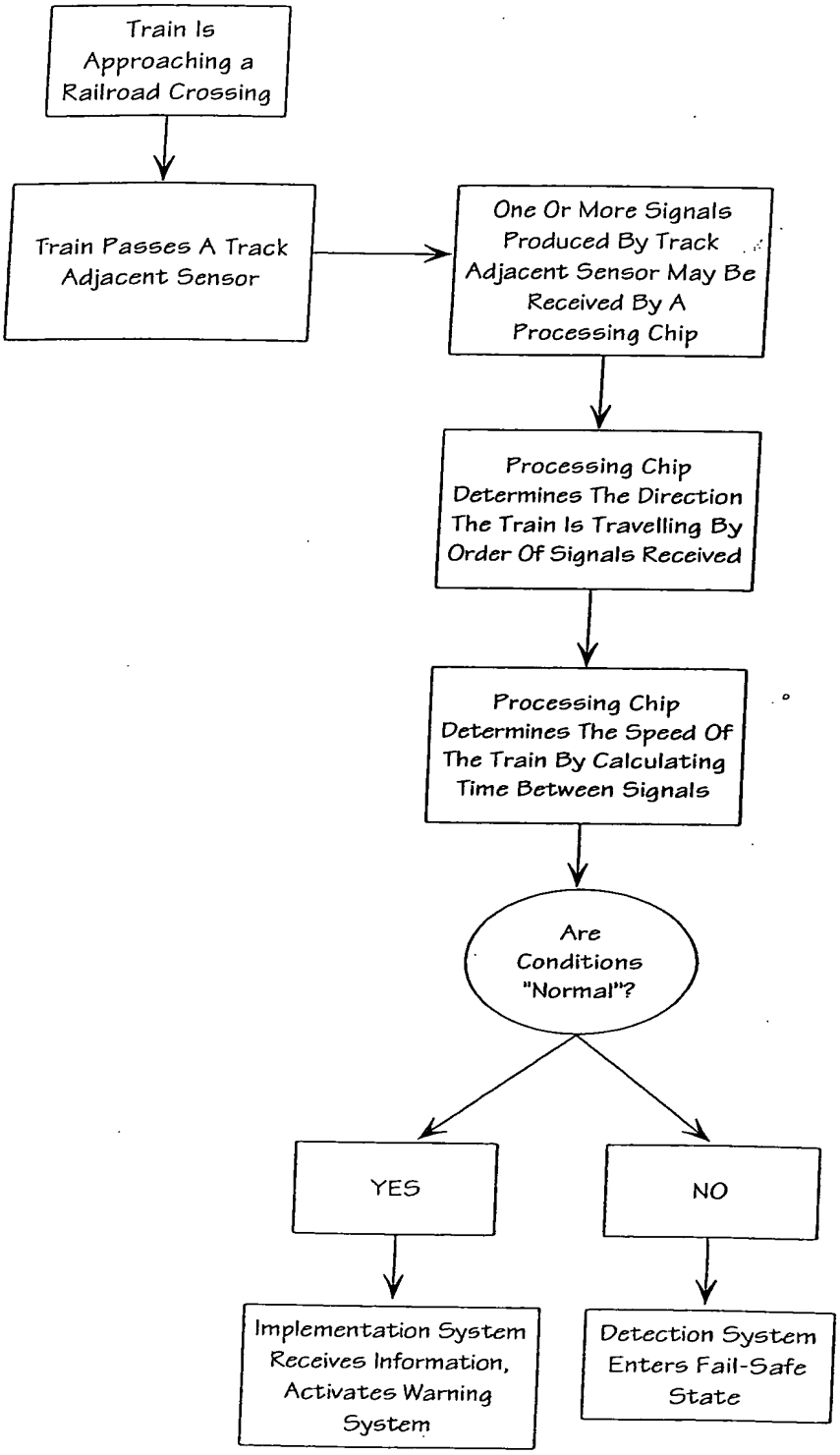
Train Is Approaching a Railroad Crossing
Train Passes A Track Adjacent Sensor
One Or More Signals Produced By Track Adjacent Sensor May Be Received By A Processing Chip
Processing Chip Determines The Direction The Train Is Travelling By Order Of Signals Received
Processing Chip Determines The Speed Of The Train By Calculating Time Between Signals
Are Conditions "Normal"?
YES
NO
Implementation System Receives Information, Activates Warning System
Detection System Enters Fail-Safe State

FIG. 8

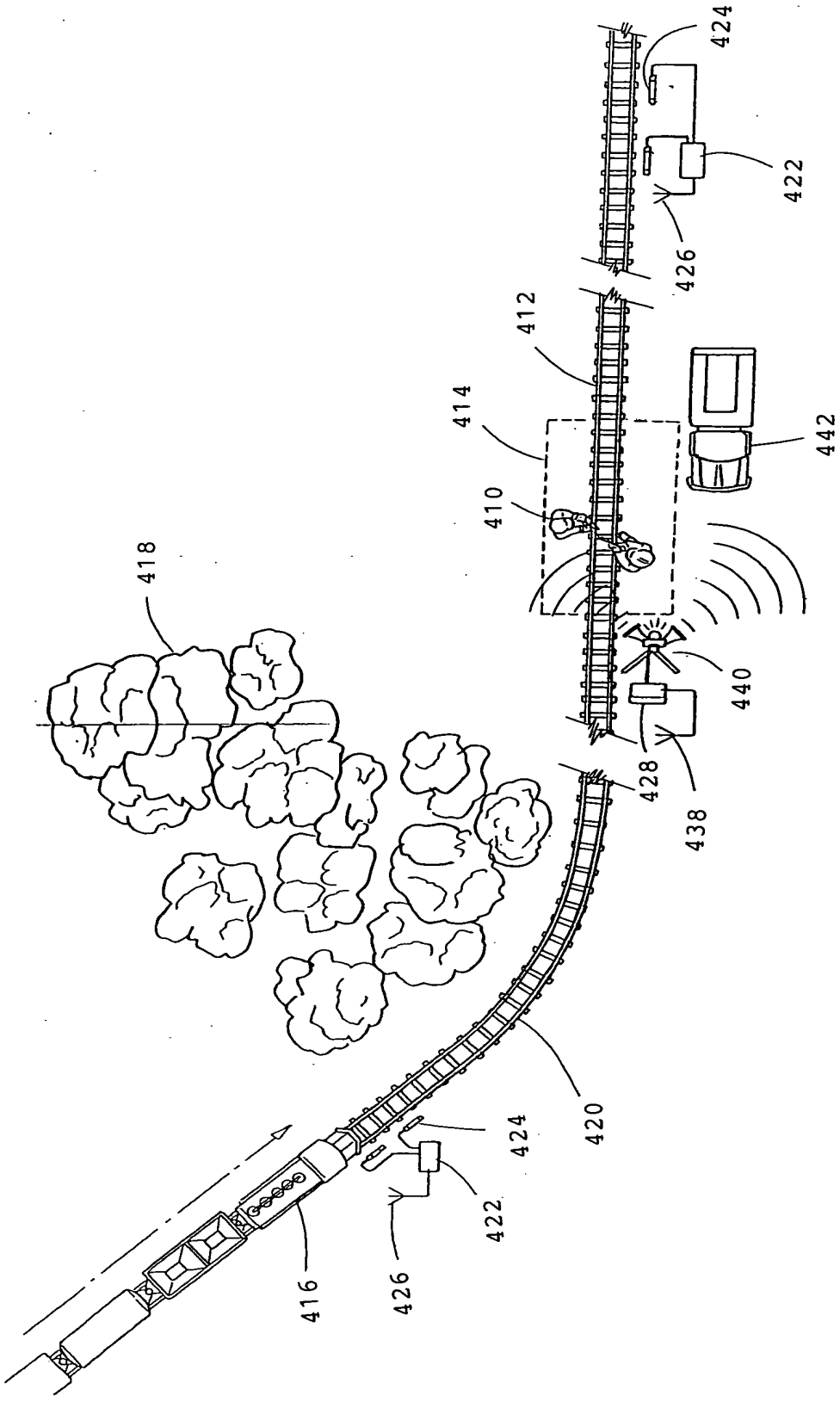

FIG. 9

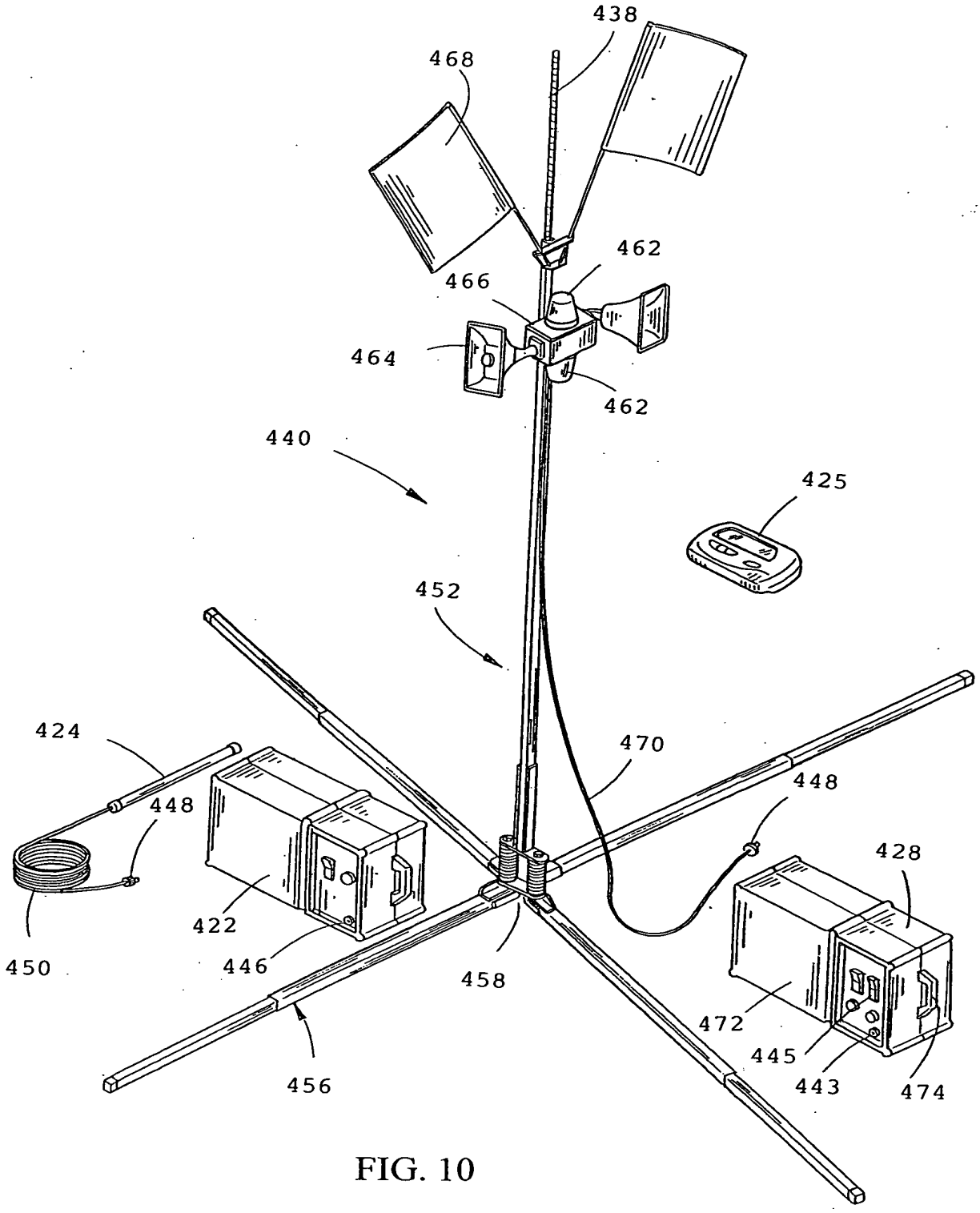
438
468
462
466
464
462
440
425
452
424
448
470
448
428
422
446
458
450
472
445
443
474
456

FIG. 10

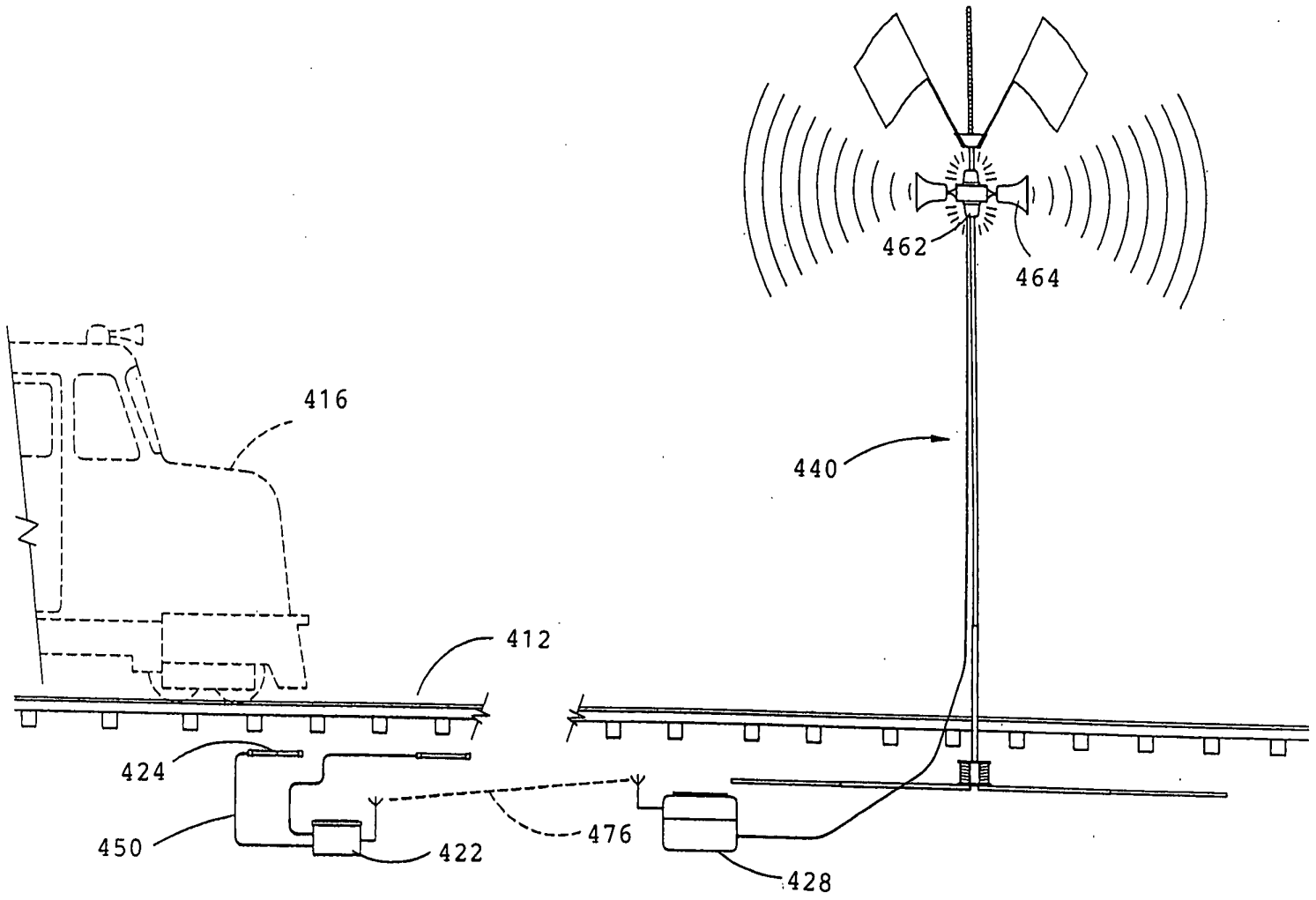

FIG. 11

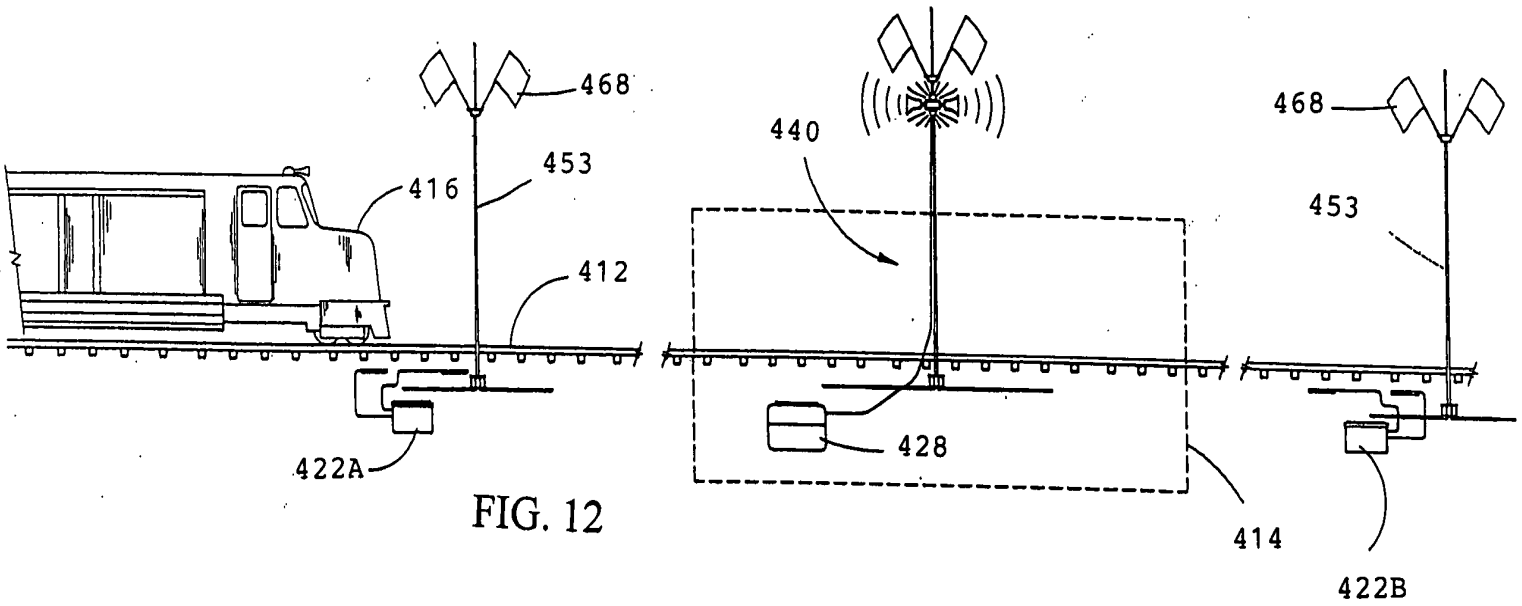

FIG. 12

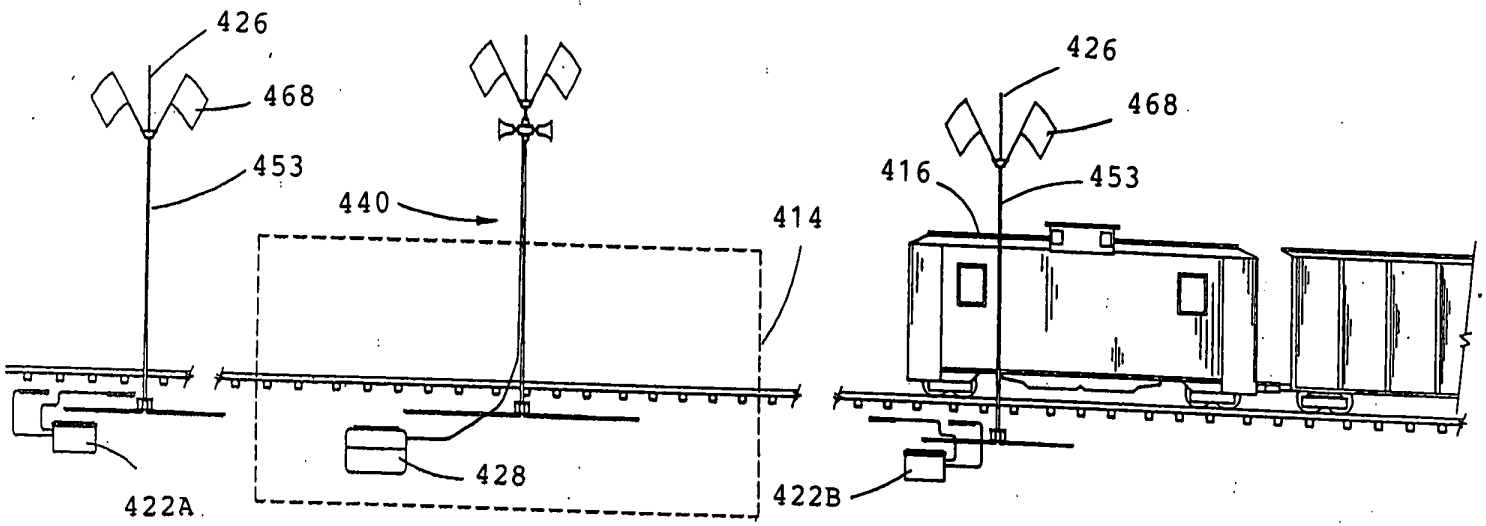

FIG. 13

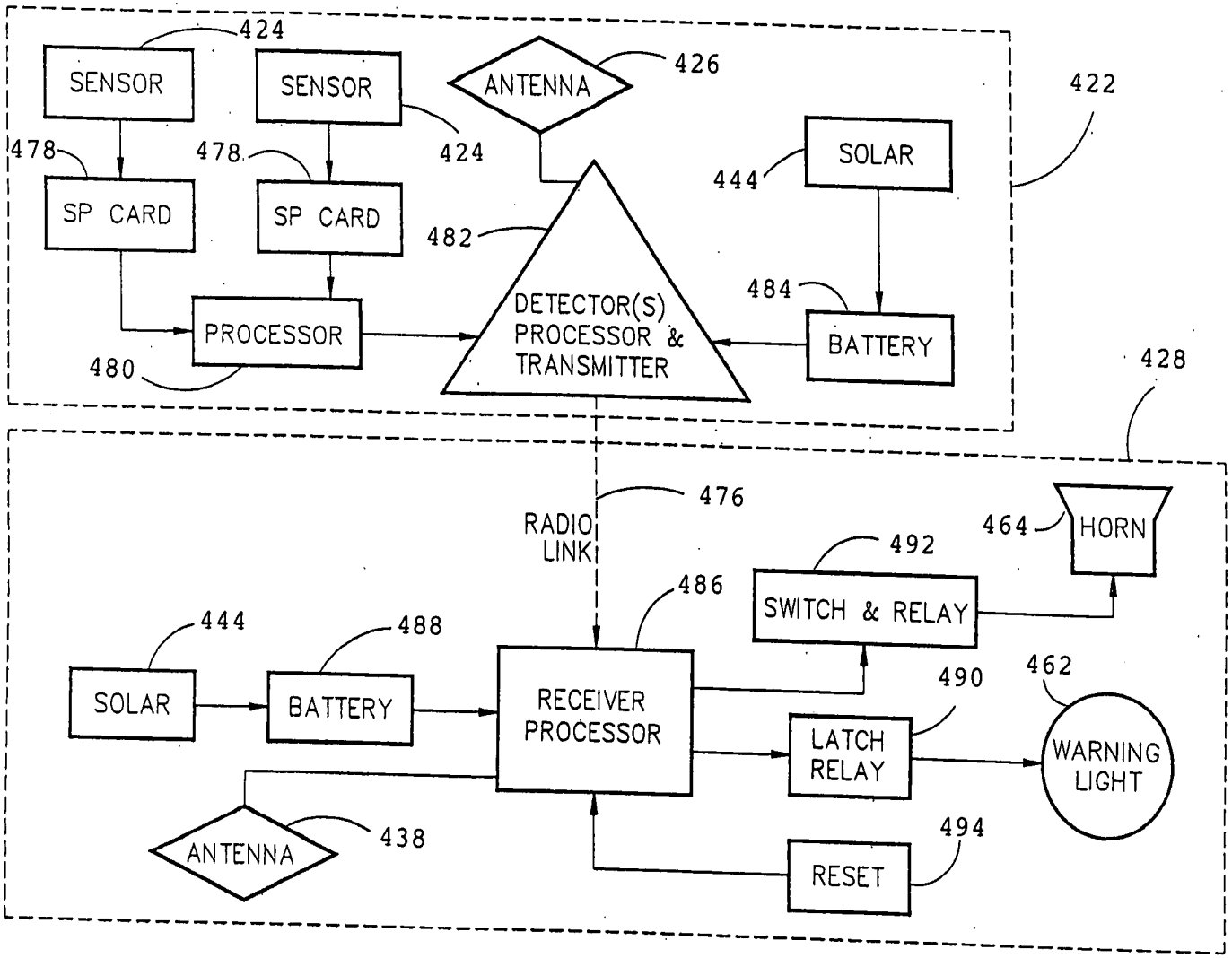
424
SENSOR
SENSOR
ANTENNA
426
422
478
478
424
SOLAR
444
SP CARD
SP CARD
482
484
DETECTOR(S)
PROCESSOR &
TRANSMITTER
PROCESSOR
BATTERY
480
428
476
RADIO
LINK
464
HORN
492
SWITCH & RELAY
486
444
488
SOLAR
BATTERY
RECEIVER
PROCESSOR
490
462
LATCH
RELAY
WARNING
LIGHT
ANTENNA
438
494
RESET

FIG. 14

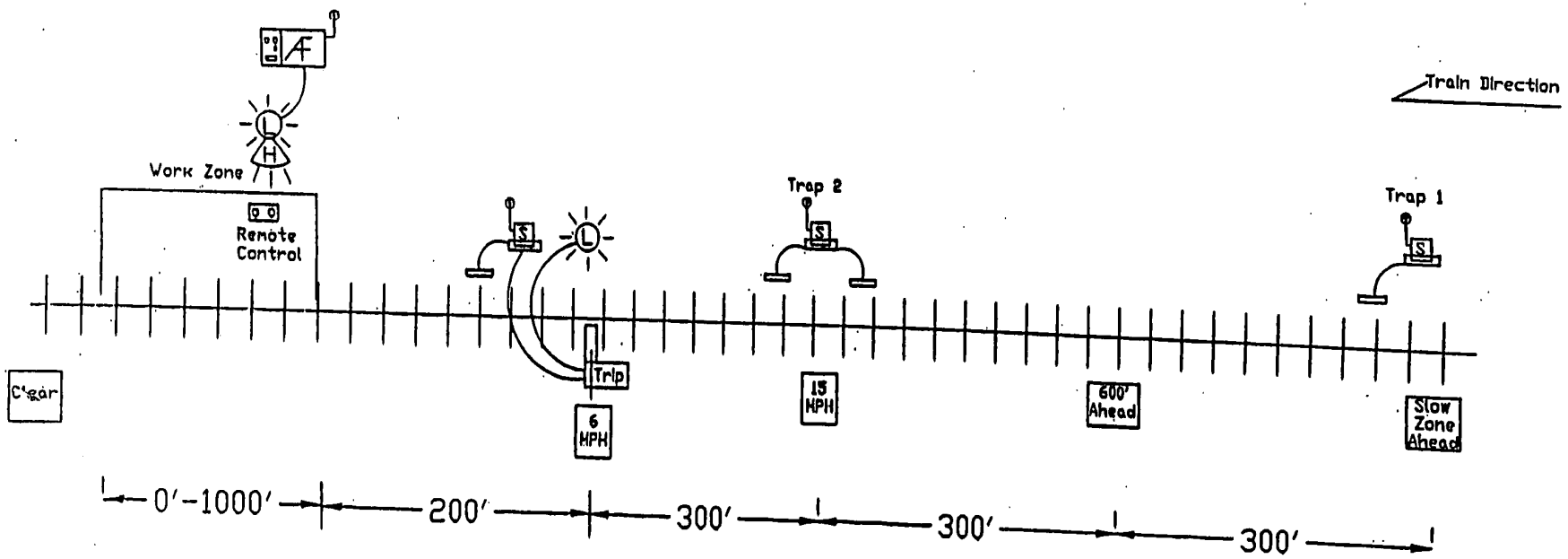
Train Direction
Work Zone
Remote Control
Trap 2
Trap 1
Trip
Clear
6 MPH
15 MPH
600' Ahead
Slow Zone Ahead
0'-1000'
200'
300'
300'
300'

FIG. 15

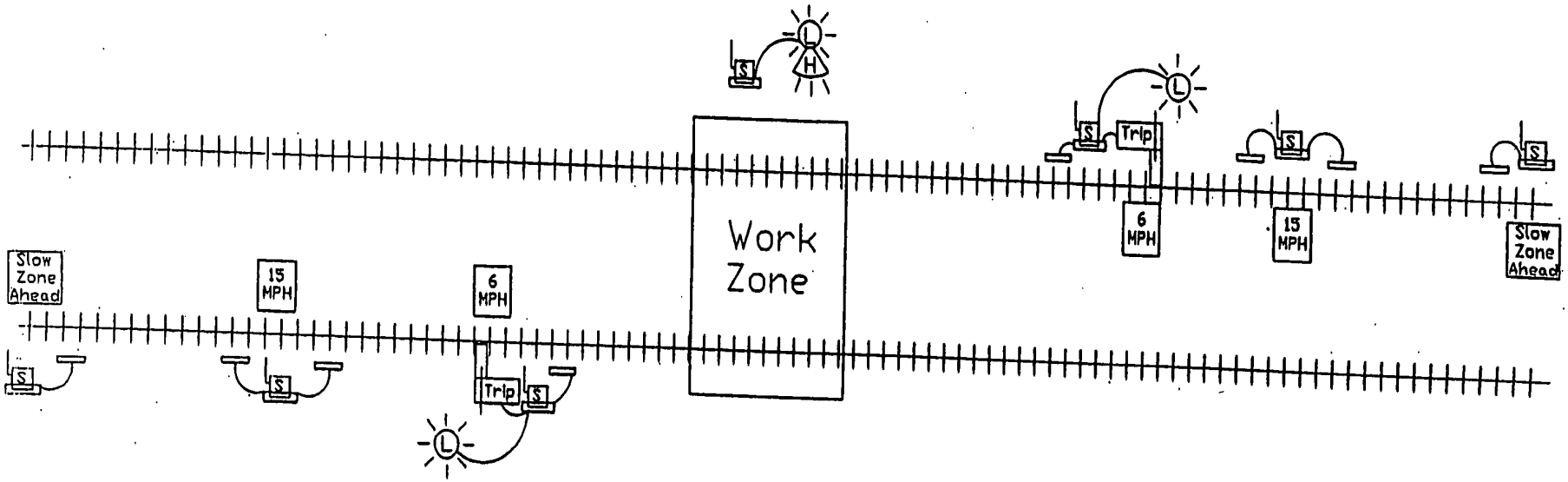
Slow Zone Ahead
15 MPH
6 MPH
Work Zone
Trip
6 MPH
13 MPH
Slow Zone Ahead

FIG. 16

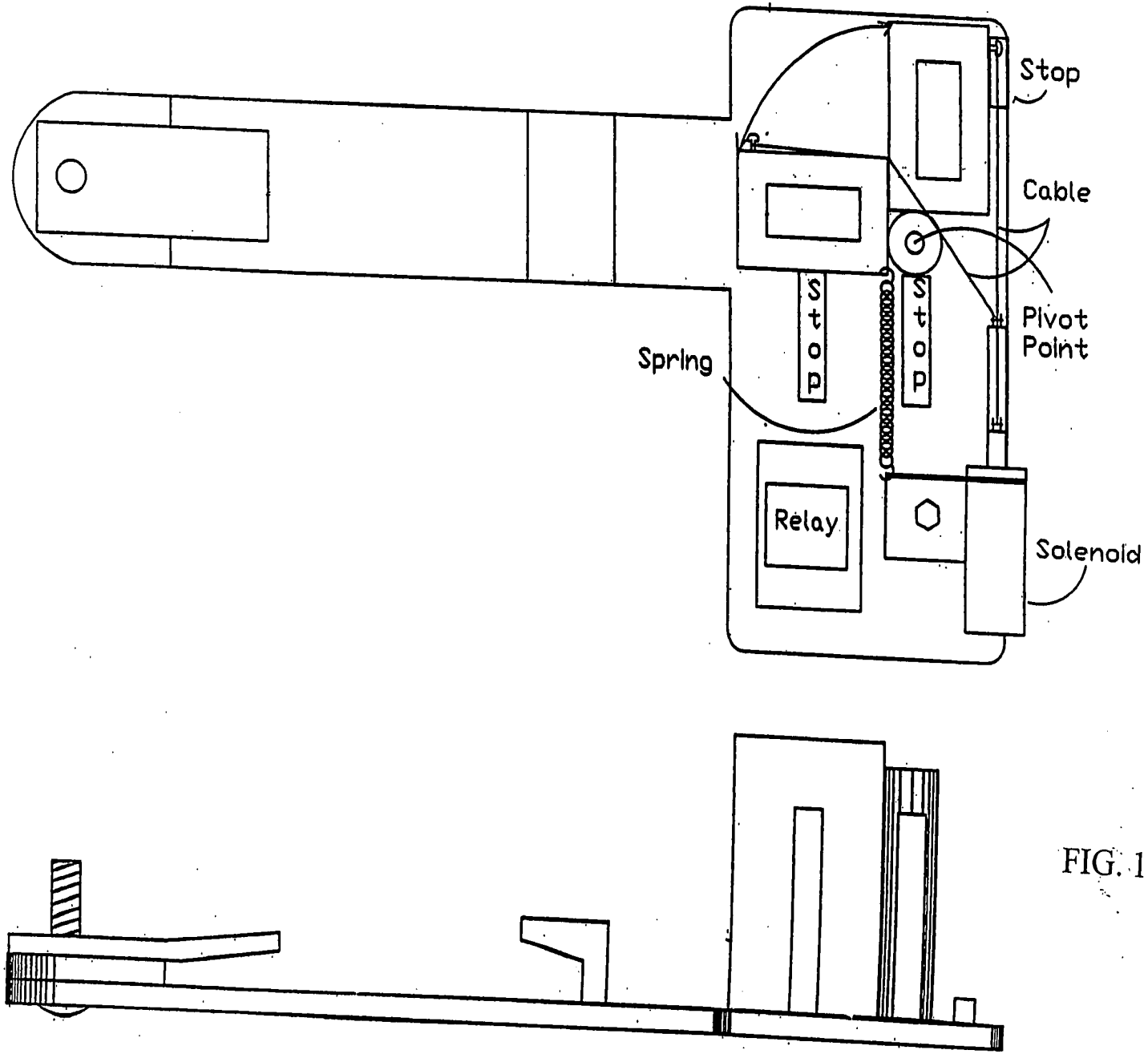

FIG. 17

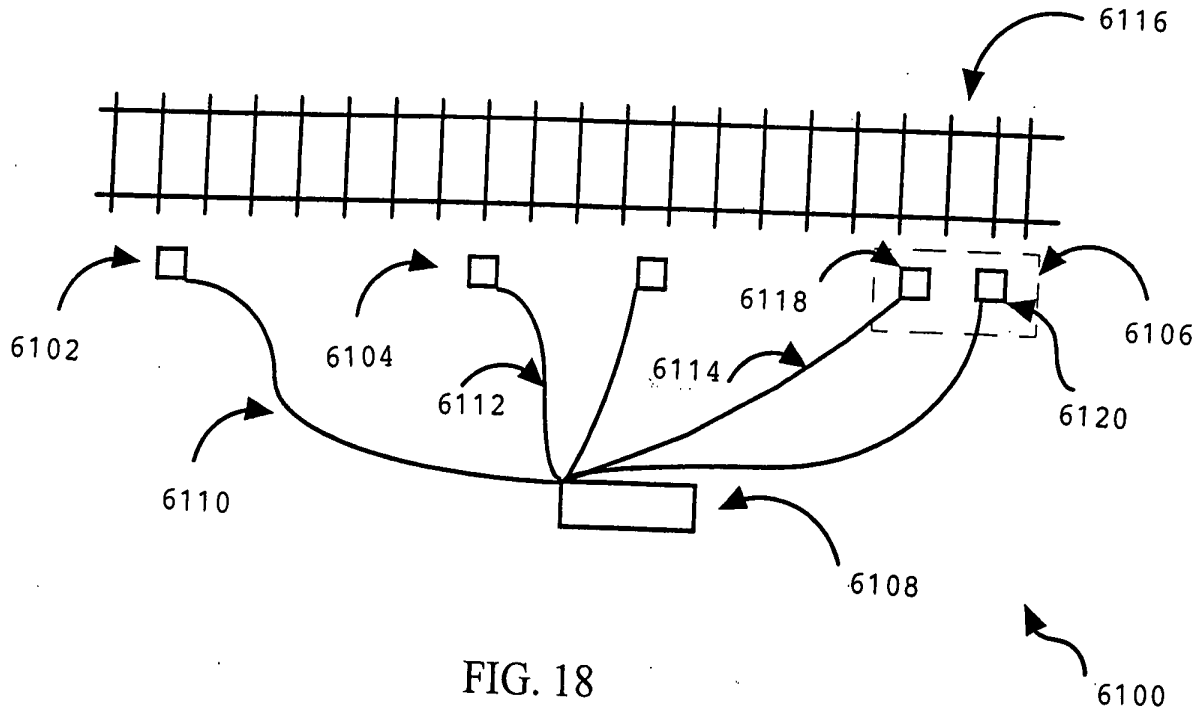

FIG. 18

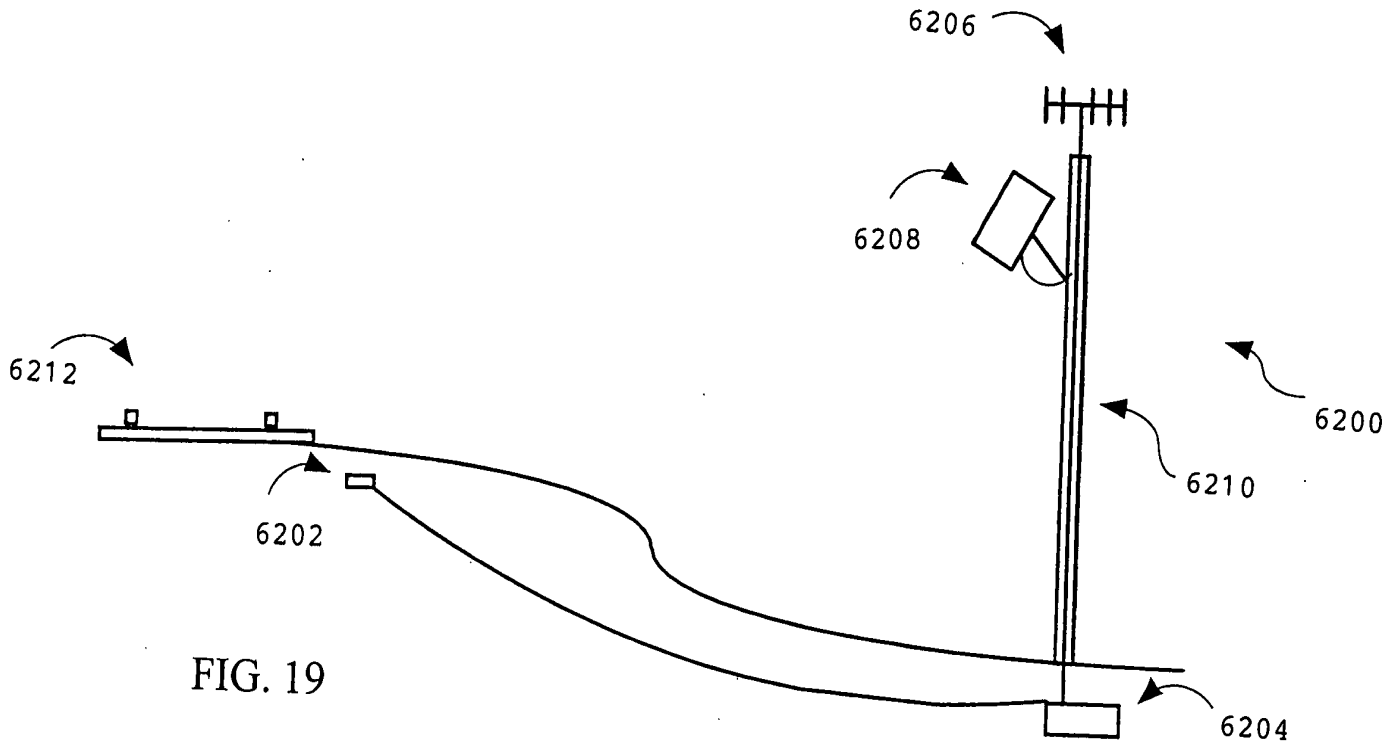

FIG. 19

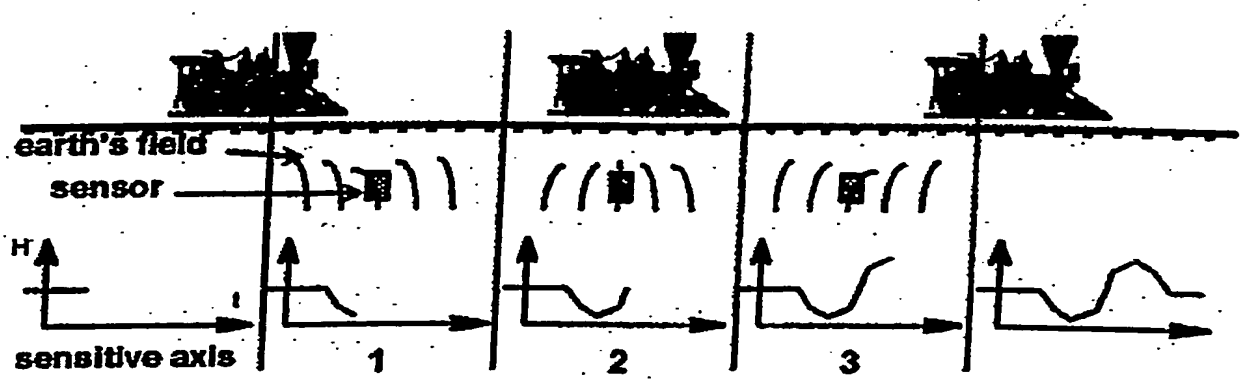
earth's field
sensor
H
sensitive axis
1
2
3

FIG. 20

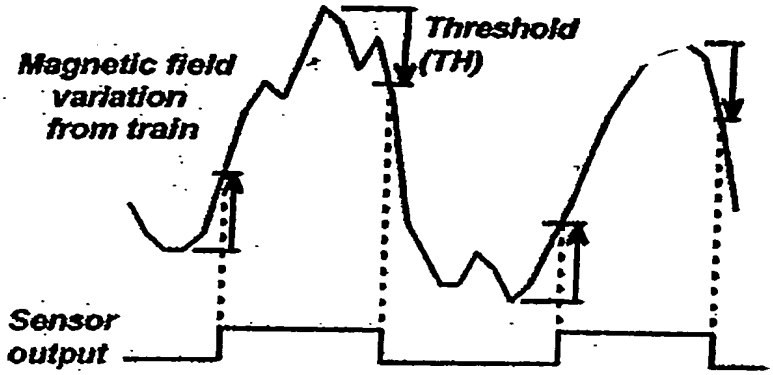
Threshold
(TH)
Magnetic field
variation
from train
Sensor
output

FIG. 21

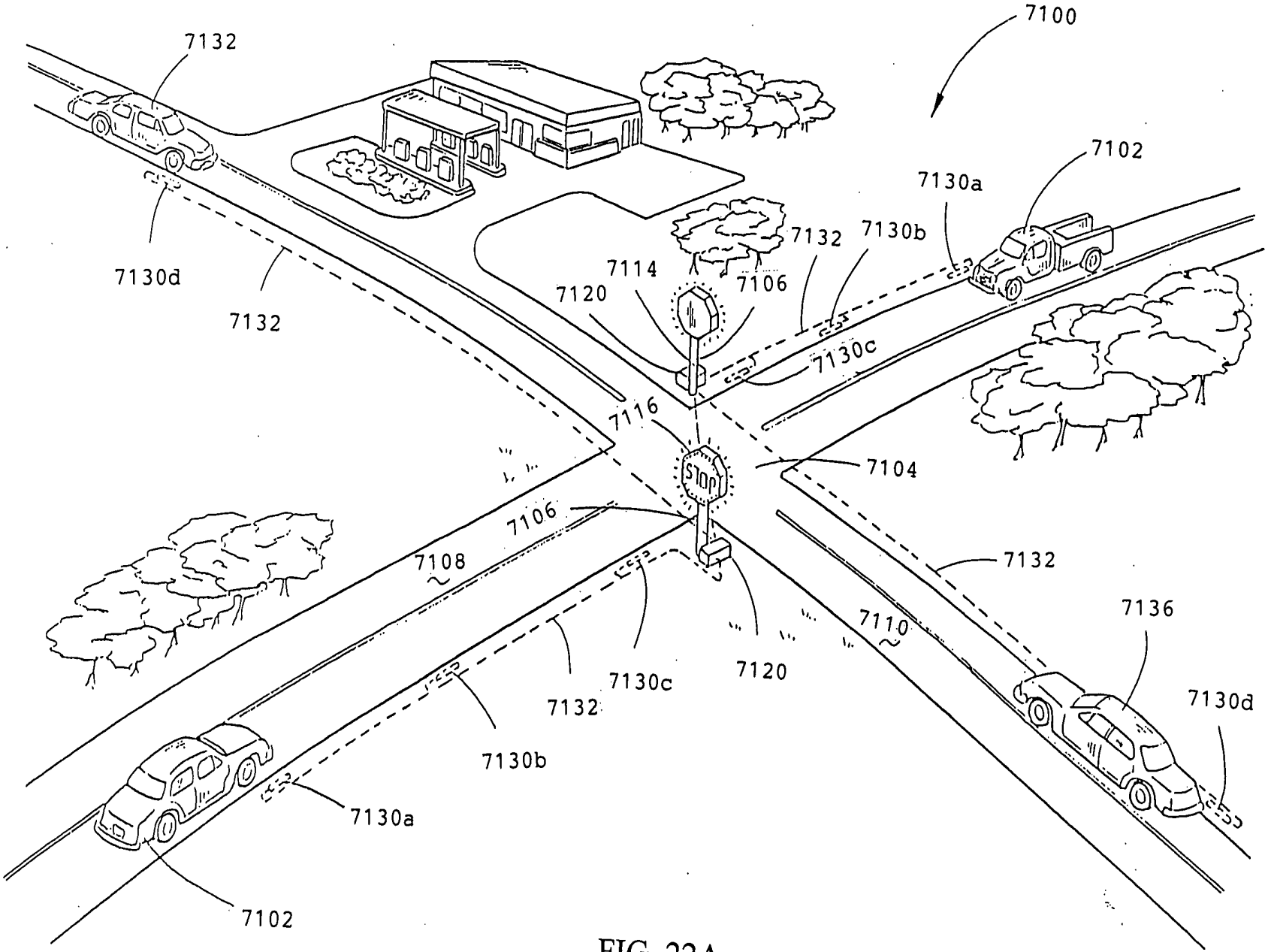
7100
7132
7102
7130a
7130d
7132
7132
7130b
7114
7120
7106
7130c
7116
7104
STOP
7106
7108
7132
7136
7110
7130c
7120
7132
7130b
7130d
7130a
7102

FIG. 22A

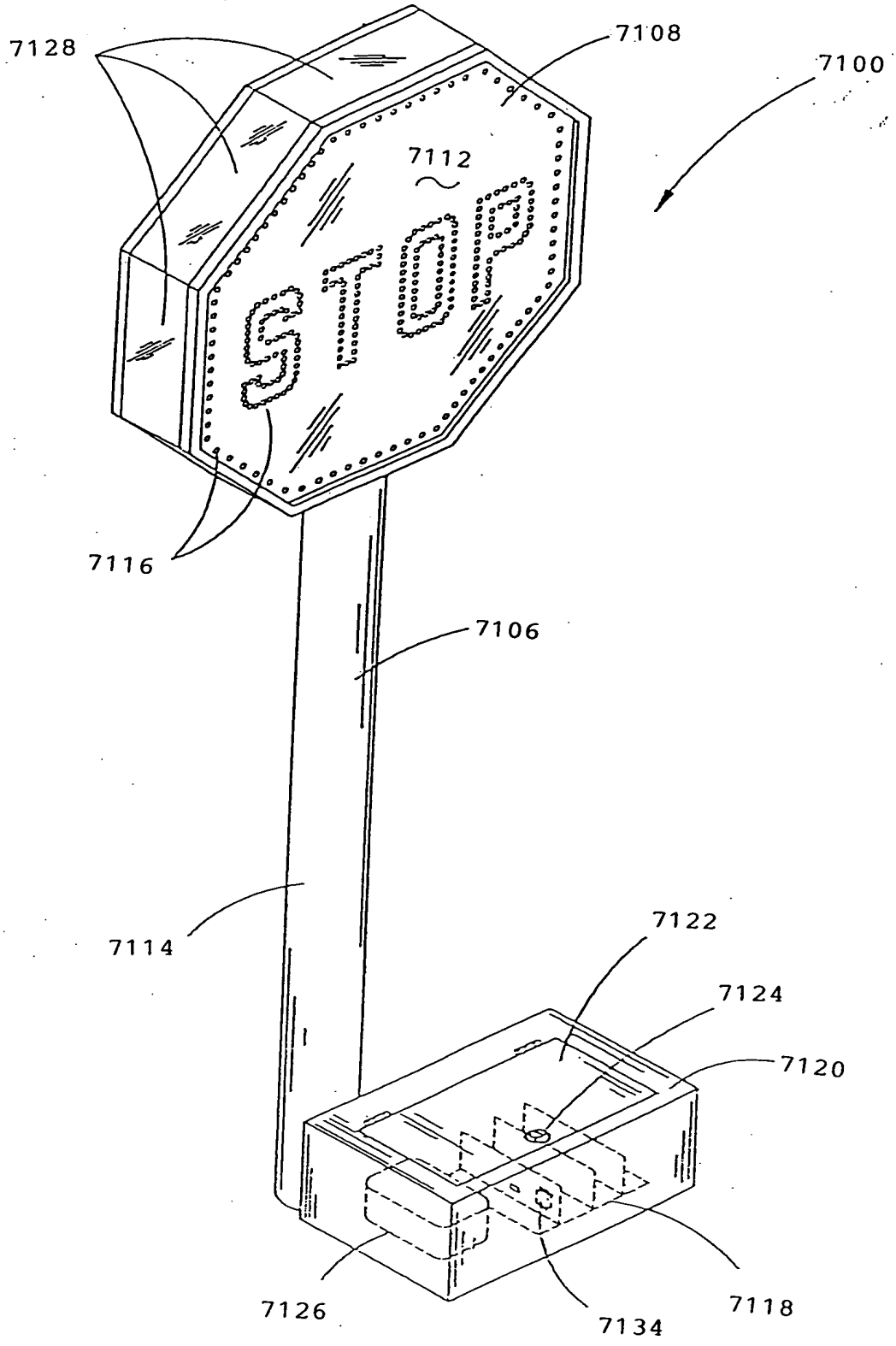
7128
7108
7100
7112
STOP
7116
7106
7114
7122
7124
7120
7126
7134
7118

FIG. 22B

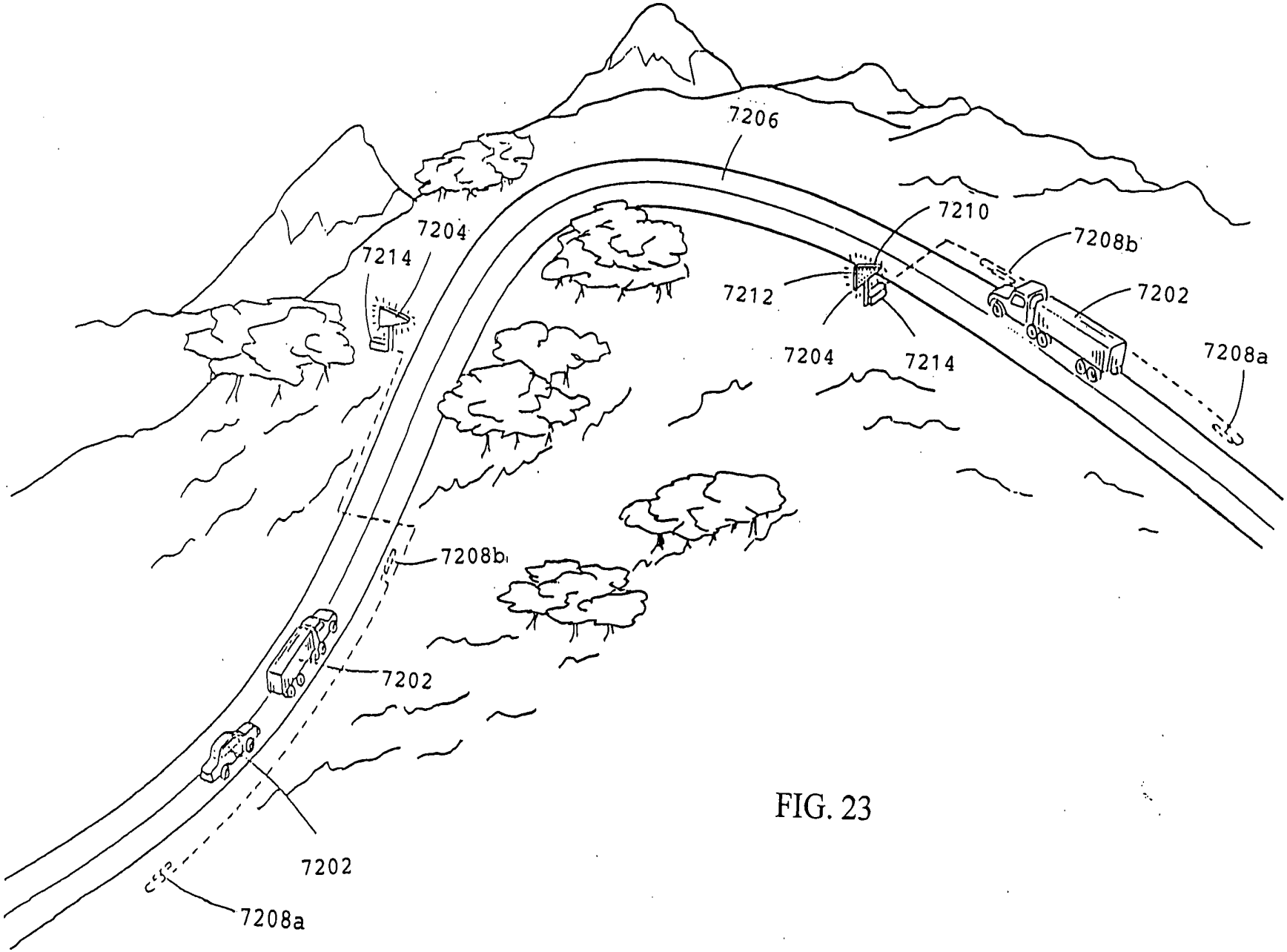
7206
7210
7208b
7204
7214
7212
7202
7204
7214
7208a
7208b
7202
7202
7208a

FIG. 23

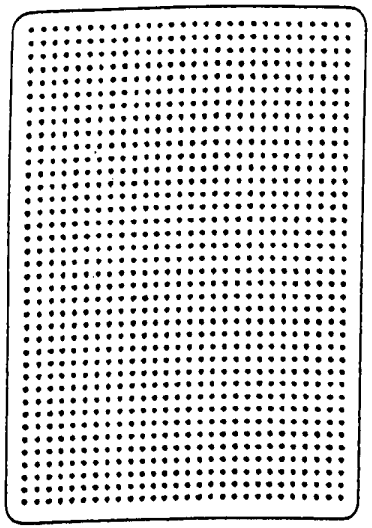

FIG. 24A

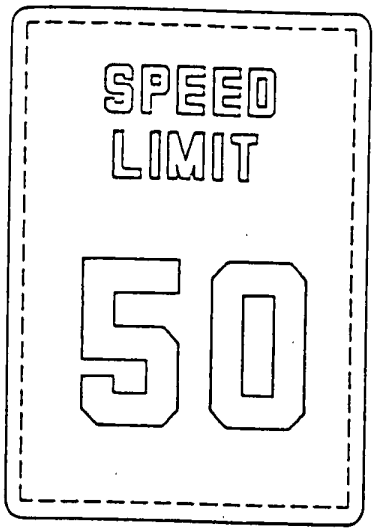

FIG. 24B

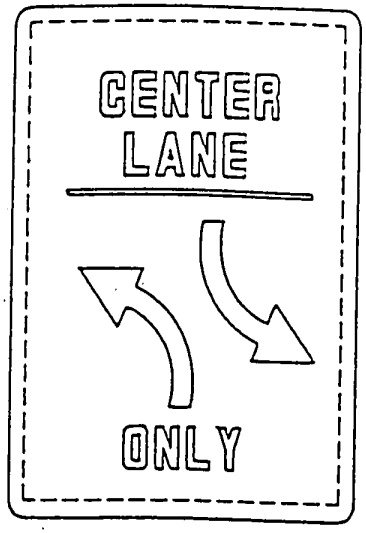

FIG. 24C

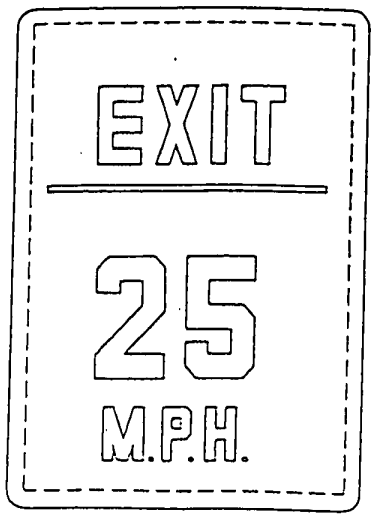

FIG. 24D

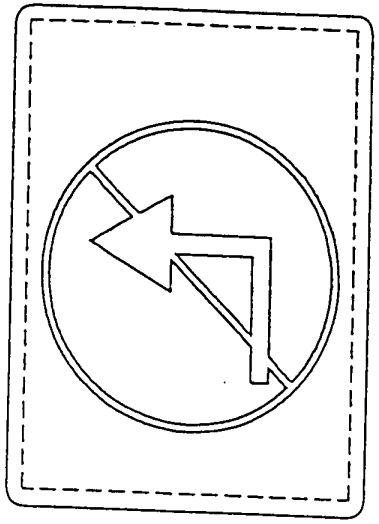

FIG. 24E

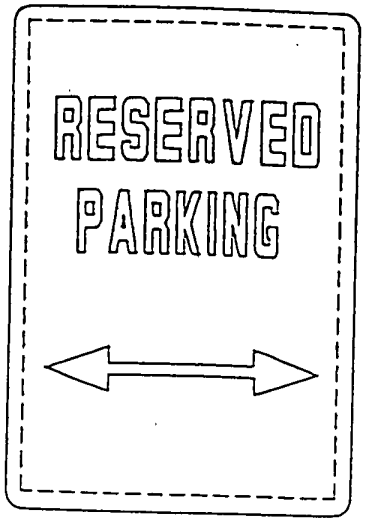

FIG. 24F

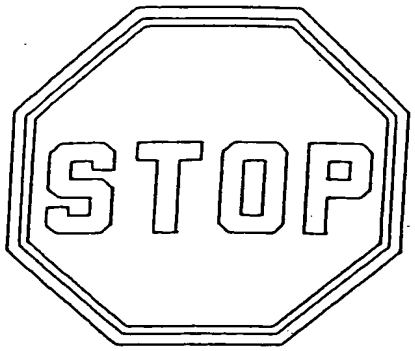

FIG. 24G

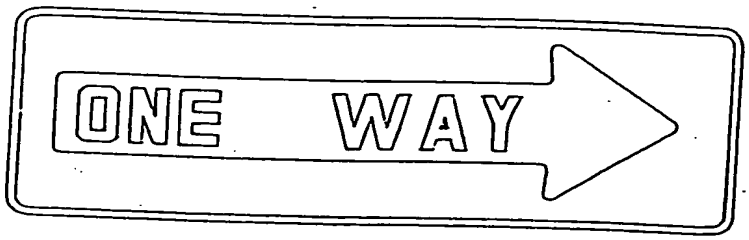

FIG. 24H

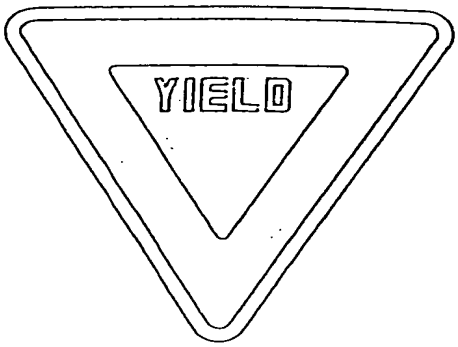

FIG. 24I

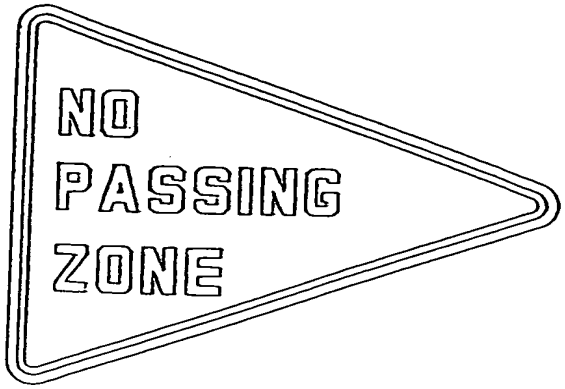

FIG. 24J

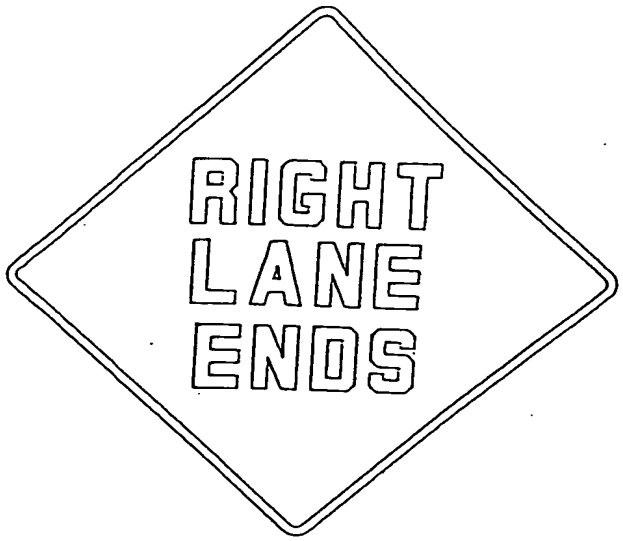

FIG. 24K

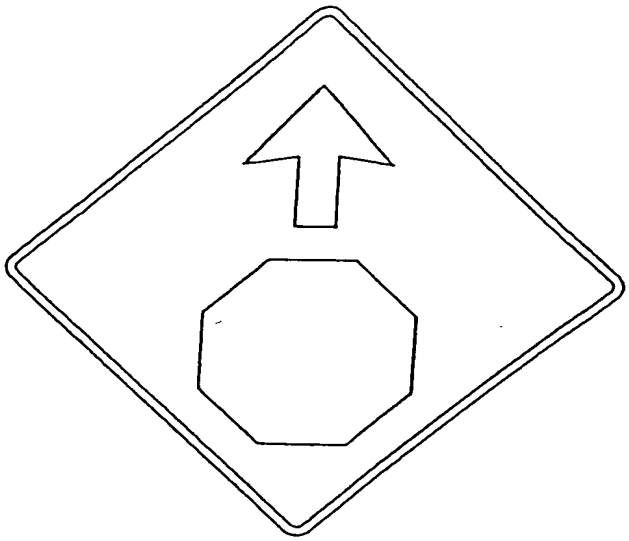

FIG. 24L

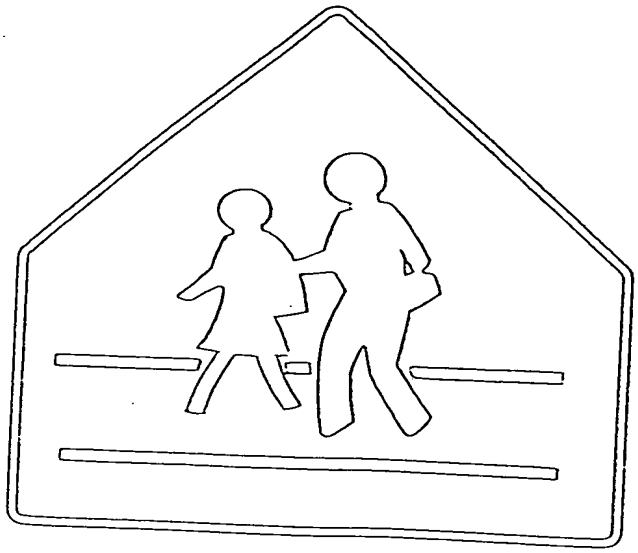

FIG. 24M

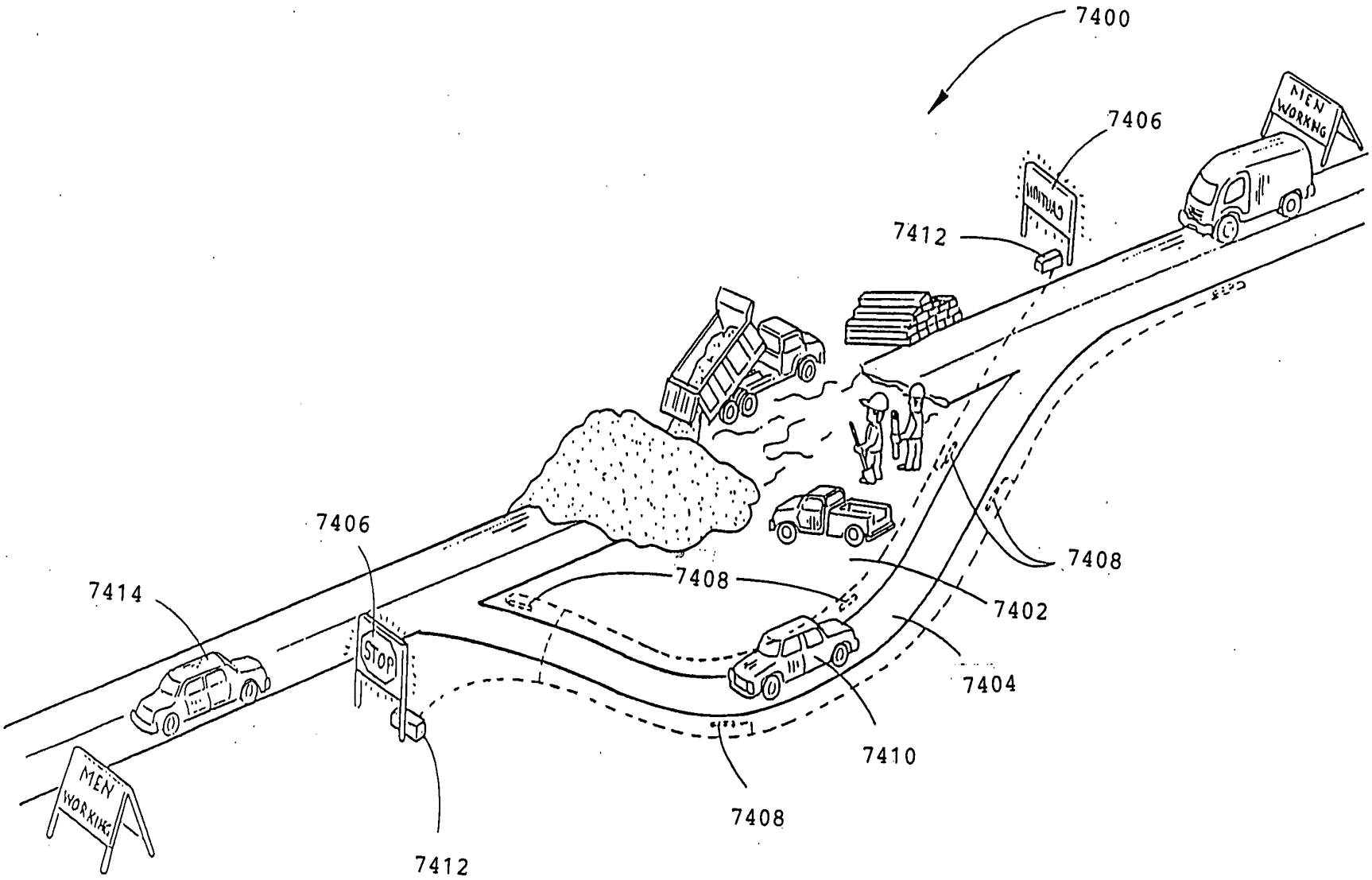
7400
7406
MEN WORKING
7412
7406
7414
STOP
7408
7408
7402
7404
7410
MEN WORKING
7408
7412

FIG. 25

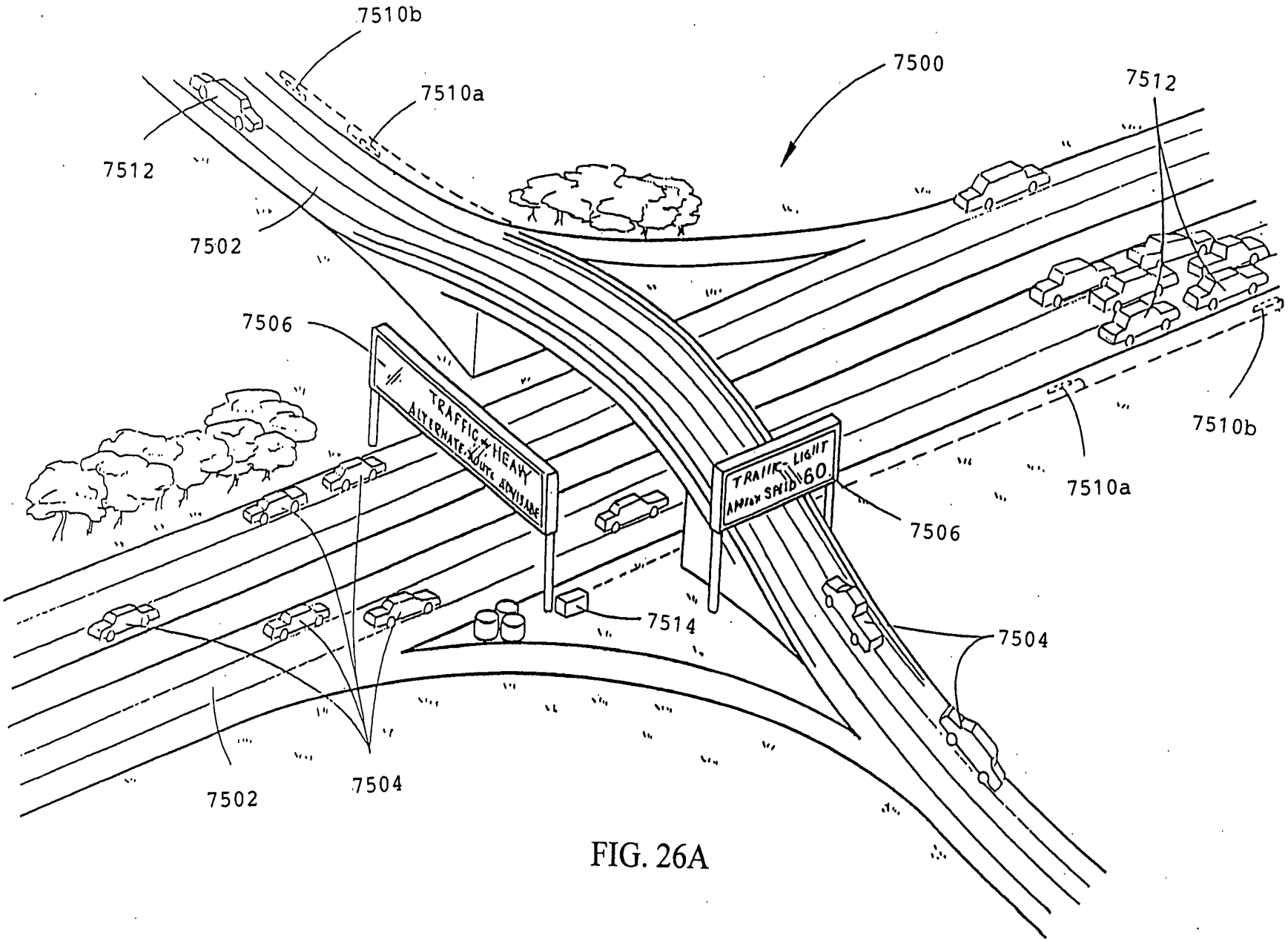
7510b
7500
7512
7510a
7512
7502
7506
TRAFFIC HEAVY
ALTERNATE ROUTES AVAILABLE
TRAFFIC LIGHT
AHEAD SPEED 60
7510b
7510a
7506
7514
7504
7504
7502

FIG. 26A

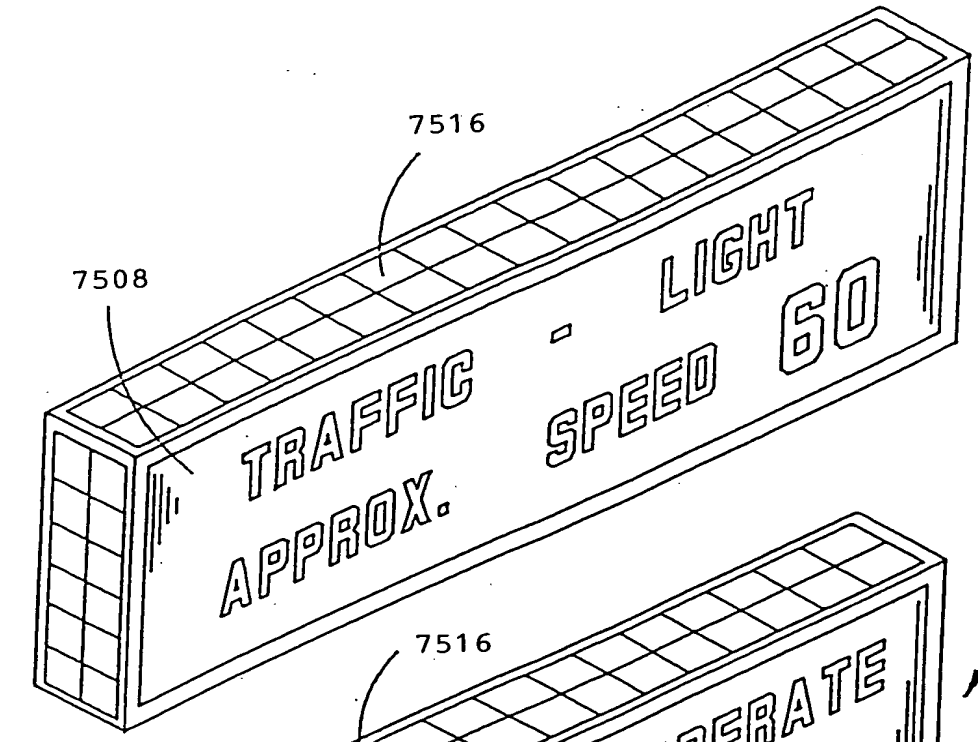

FIG. 26B

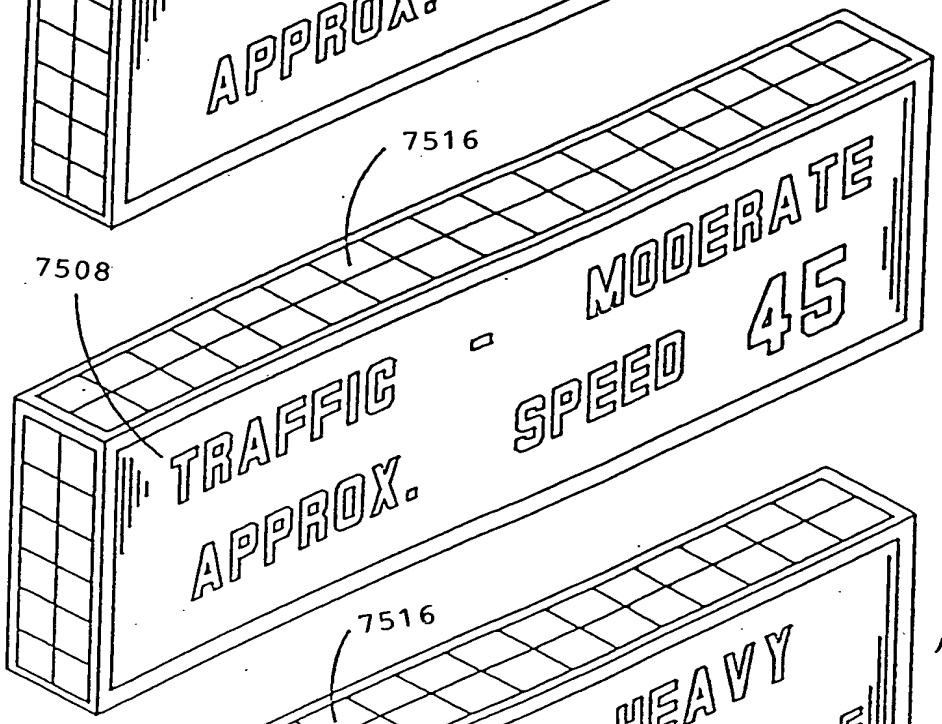

FIG. 26C

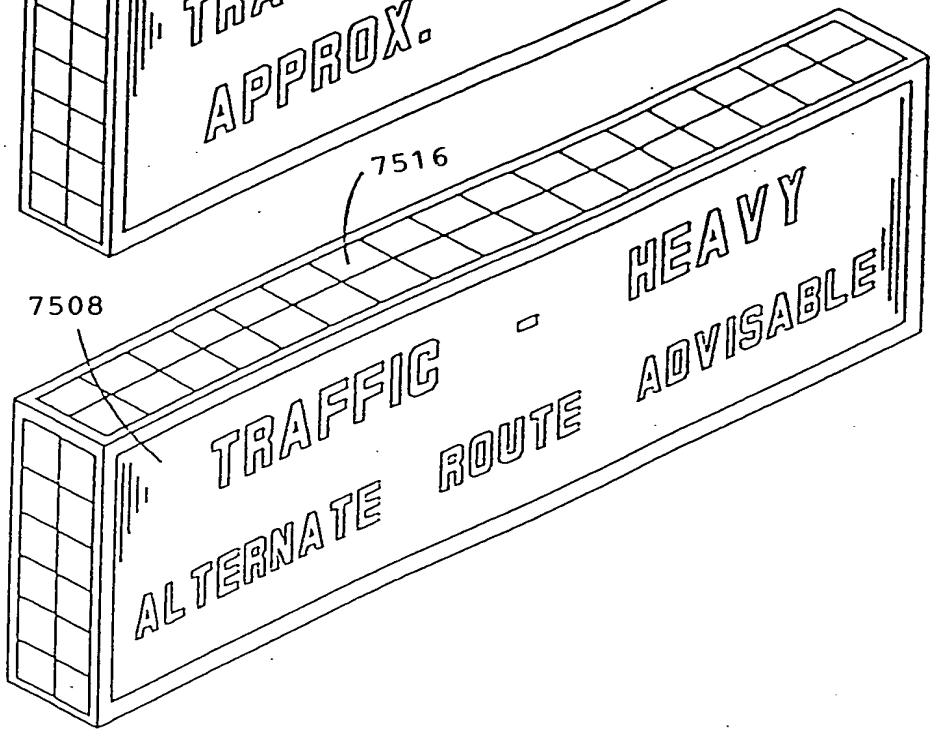

FIG. 26D

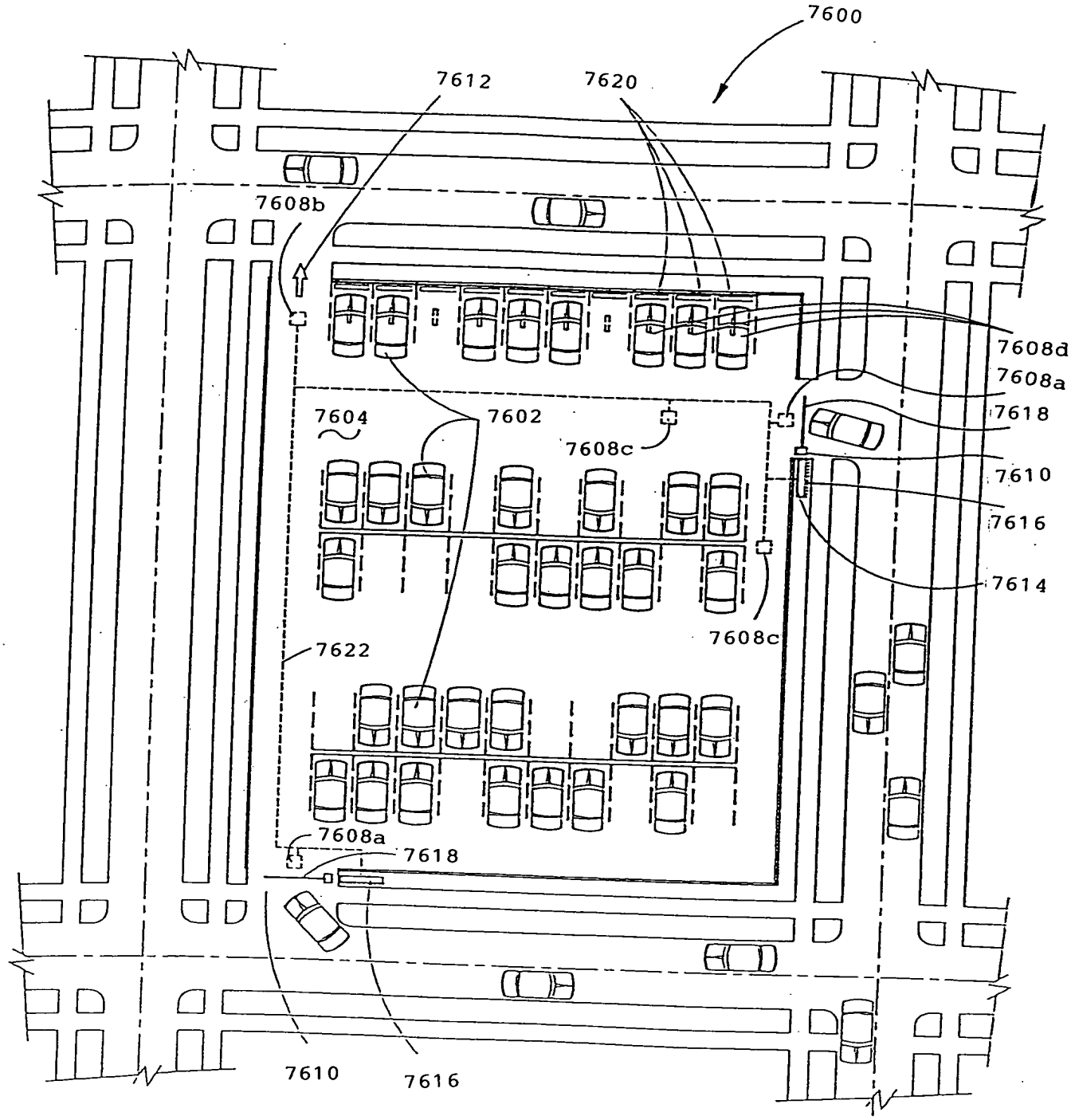
7600
7612
7620
7608b
7608d
7608a
7618
7604
7602
7608c
7610
7616
7614
7608c
7622
7608a
7618
7610
7616

FIG. 27A

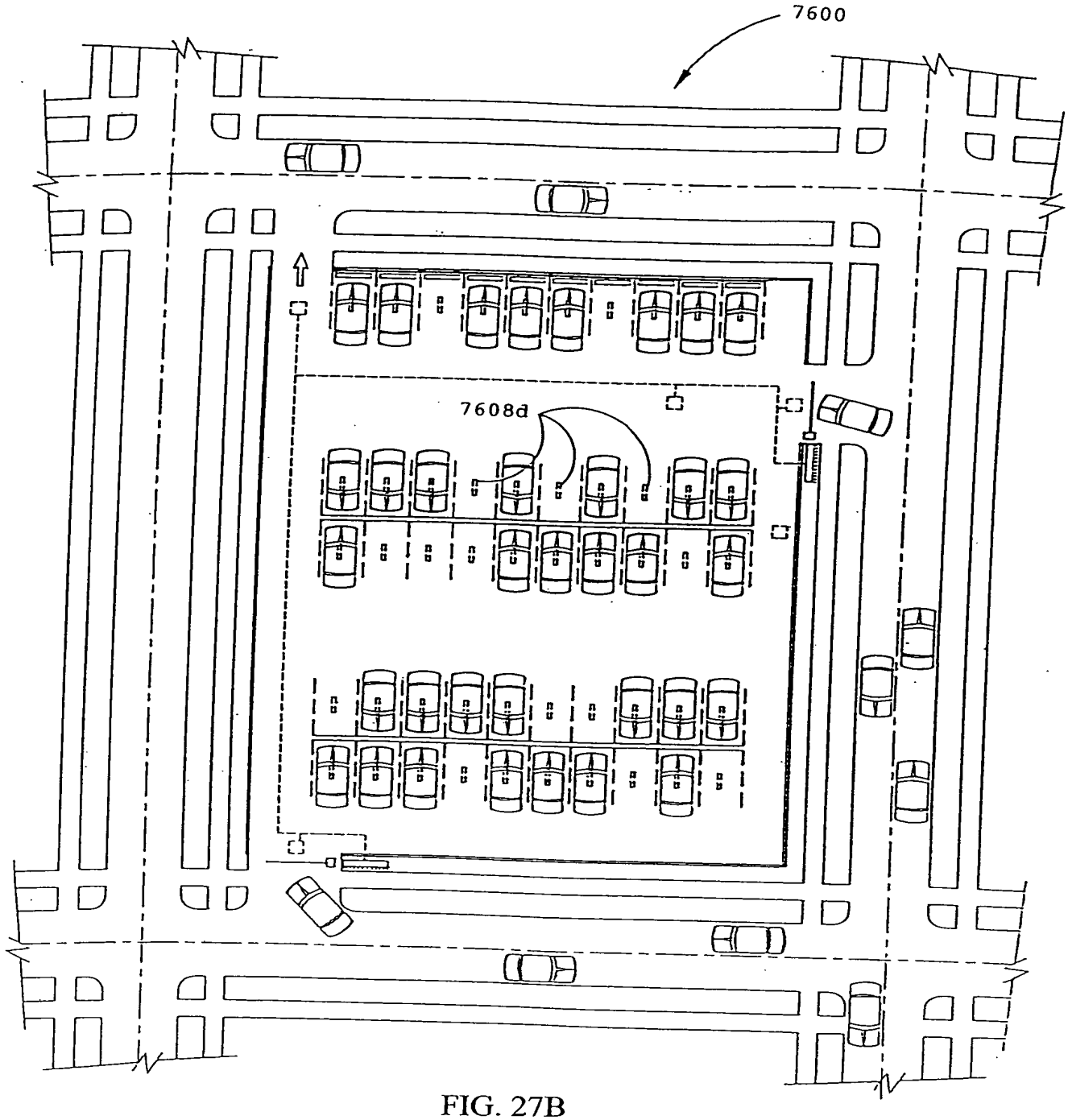

FIG. 27B

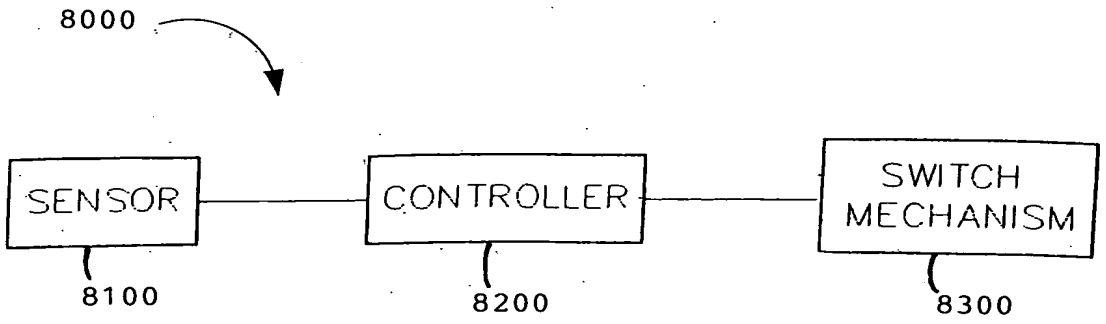
8000
SENSOR
CONTROLLER
SWITCH MECHANISM
8100
8200
8300

FIG. 28

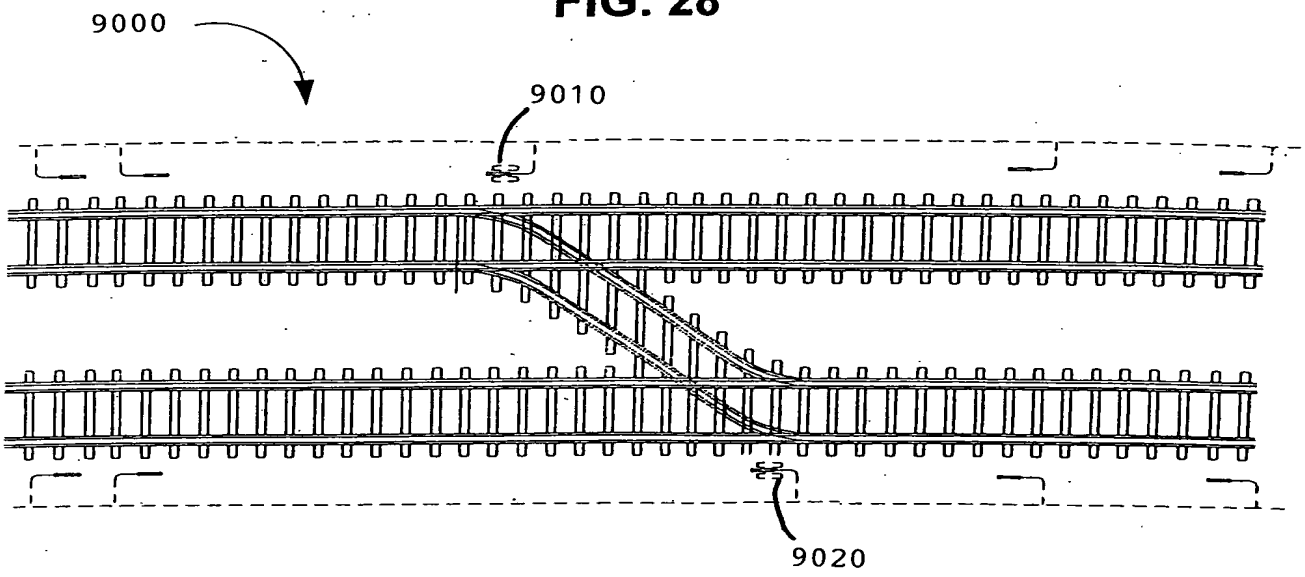
9000
9010
9020

FIG. 29

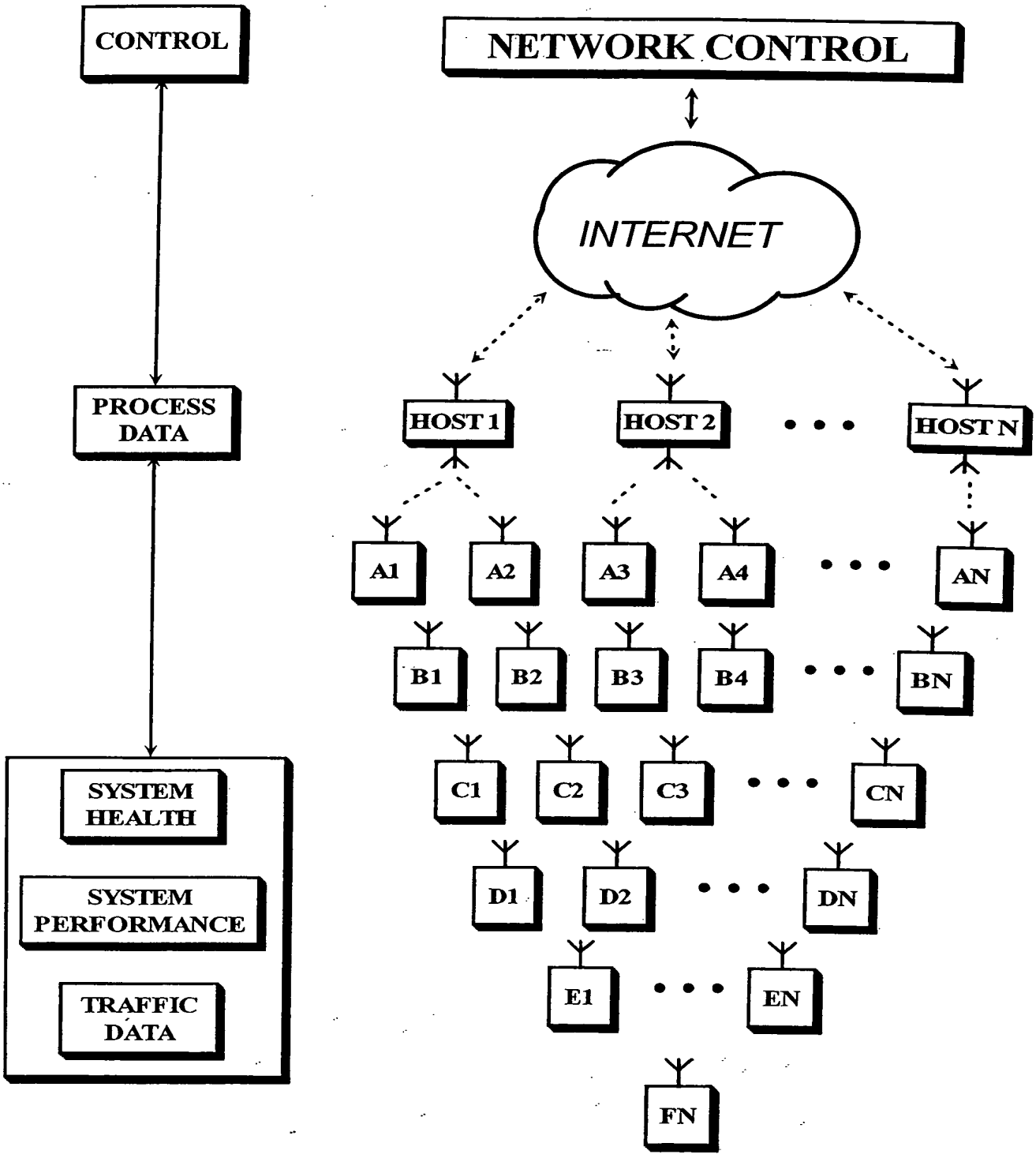
CONTROL
PROCESS DATA
SYSTEM HEALTH
SYSTEM PERFORMANCE
TRAFFIC DATA
NETWORK CONTROL
INTERNET
HOST 1
HOST 2
HOST N
A1
A2
A3
A4
AN
B1
B2
B3
B4
BN
C1
C2
C3
CN
D1
D2
DN
E1
EN
FN

FIG. 30